GIBSON'S
ANATOMY

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THE

ANATOMY of Humane Bodies,

Dignum cenſemus qui Imprimatur.

Daniel Whiſtler, M. D. and President of the *King's College* of Phyſicians, *London.*

Th. Witherley, Elector & Cenſor.

Joh. Atfield,
Edv. Browne, } Cenſors.
Tho. Alvey,

THE ANATOMY OF Humane Bodies EPITOMIZED.

WHEREIN
All the *PARTS* of Man's Body, with their *ACTIONS* and *USES*, are ſuccinctly deſcribed, according to the neweſt Doctrine of the moſt Accurate and Learned Modern Anatomiſts.

The Fourth Edition, *Corrected and Inlarged both in the Diſcourſe and Figures.*

By *THO. GIBSON*, M.D. Fellow of the College of Phyſicians, *London*.

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TO THE
READER.

HAving in the former Impreſſions of this Book made known what firſt induc'd me to the publiſhing of it, I ſhall not need now again to mention what has been but too often already repeated. But an account ought to be given, why there were no Alterations nor Additions in the laſt *Impreſſion* (*viz.* the *third*) as well as in the *ſecond* and *this*; the rather, becauſe the Title intimated that there were.

Let the *Reader* therefore know, That the greateſt part of the Amendments and Additions that are now publiſhed in this, were intended for that Edition, and were ready when it was made. But the better half of that Impreſſion was done, before ever I knew it was begun: And ſo the whole was finiſhed without my being at all concern'd in it. How well it was printed after the *ſecond*, I know not, having never lookt into it; for this is done after the *ſecond*, except the Improvements of it. And I hope thoſe who have bought the former Impreſſions, will not reckon it for a Fault, that *This* pretends to be more correct and complete than they; for to have continued the known Errours and Imperfections thereof, would have been an Injury both to the Reader,and my ſelf; *To the Reader*, in obtruding acknowledg'd Errours, and concealing new Diſcoveries; And *to my ſelf*, in giving occaſion to be thought negligent in what I have taken ſo great pains in, and ignorant of what I know.

But my publiſhing this Book now a *fourth* time in *Engliſh*, needs a better Apology than I can give: Only this I can ſay, That tho' it ſpeak Engliſh, yet none ſhall well underſtand it, that is a ſtranger to the more learned Languages: And therefore it diſdains the Converſation of Quacks and old Women, leaving them to meditate on the traditional Virtues of their Receipts, without offering to inſtruct them in *the Knowledge of themſelves*, of which their Ignorance and Impudence render them incapable in any ſenſe.

Its Ornaments indeed are in a great meaſure borrow'd, but it fears not the Fate of the *Daw* in the Fable, to be unplum'd and laugh'd at; becauſe they are not *furtivi colores*, ſeeing it ſtruts not in them as its own, but has every where the ingenuity to confeſs the true Owners, whom if the Reader deſire to know, it here preſents him with a Liſt of the principal,

Adrian. Spigelius *de humani corporis fabrica.*
Isbrandi de Diemerbroeck *Anatome corporis humani.*
Thomæ Bartholini *Anatome.*
D. Williſius *de Cerebro.*
------*Exercitationes Medico-phyſicæ duæ,* 1. *De Sanguinis accenſione,* 2. *De motu Muſculari.*
------*De primis viis & de reſpirationis organis* in his firſt and ſecond part of his *Pharmaceutice rationalis.*
Dr. Highmore'*s Corp. hum. diſq. Anatomica.*
M. Malpighii *Epiſtolæ Anatomicæ de Cerebro, Linguâ, Tactûs organo.*
------*De viſcerum ſtructura,* viz. *Hepatis, Cerebri corticis, & Lienis.*
------*Exercit. de Omento, Ping. & Adip. duct.*
Nicolai Stenonis *Diſſertatio de Cerebri Anat.*
——*De Muſculis & Glandulis Obſervationum ſpecimen.*
------*De Glandulis Oris, & novis earundem vaſis Obſervationes Anatomicæ.*
Caroli Fracaſſati *Diſſertatio Epiſtolica de Cerebro.*
Dr. Lower'*s Tractatus de Corde.*
Dr. Gliſſon'*s Tractatus de Ventriculo & Inteſtinis.*
——*Anatomia Hepatis.*
Dr. Charlton'*s Enquiries into Humane Nature in* IV. *Anatomick Prelections in the New Theatre of the Royal College of Phyſicians in* London.

Dr, Wharton's *Adenographia*, *ſive Glandularum totius corporis deſcriptio.*

Lamb. Velthuſii *Tractatus duo Medico-phyſici, unus de Liene, alter de Generatione.*

Dr. Harvey's *Exercitationes Anatomicæ de Cordis motu, & circulatione Sanguinis.*

-----*Exercitationes de generatione Animalium.*

Caſp. Bartholin. *(Thom. F.) Diaphragmatis ſtructura nova.*

Franciſci Stockhamer, *Doctoris Medici & Anatomici Microcoſmographia.*

Laurentii Bellini *Exercitatio Anatomica de ſtructura & uſu Renum.*

Dr. Grew's *Comparative Anatomy of Stomachs and Guts*, ſubjoined to his *Muſeum Regalis Societatis.*

Anton. Nuck *de ductu ſalivali novo, ſaliva, ductibus Oculorum aquoſis, & humore aqueo.*

Gualt, Nedham *Diſquiſitio Anatomica de formato fœtu.*

Joh. Conr. Peyeri *Parerga Anatomica & Medica*, viz. *de Glandulis Inteſtinalibus*, &c.

Joh. Conrad. Brunneri *Experimenta nova circa Pancreas.*

Dr. Mayow's *Tractatus quinque Medico-phyſici*, &c.

Regneri de Graef *Opera omnia.*

Johannis Swammerdami *Miraculum Naturæ, ſive Uteri Muliebris fabrica.*

Joh. Alph. Borelli *Opus poſthumum de motu Animalium.*

*Dr.*Briggs's *Ophthalmographia,ſive Oculi ejúſq; partium Deſcriptio Anatomica.*
Dr. Cole's *Cogitata de ſecretione Animali.*
Dr. Croone *de ratione motûs Muſculorum.*
Monſ. du Verney *of the Ears.*
Dr. Henſhaw's *Aëro-Chalinos.*
Monſ. Perrault *Eſſays de Phyſique,* &c.
Steph. Blancardi *Anat. Reformata.*
Dr. Havers's *Oſteologia nova.*

Theſe, I ſay, are the Authors which have chiefly adorned this *Book*, ſeveral whereof were not ſought to in the former Editions; and thoſe that were, have now (moſt of them) been much more liberal in contributing their Symbols to make it more complete.

As it is, if it may *aſſiſt the memory* of ſuch as are *well skill'd* in Anatomy, or *inſtruct* and *direct* the young *Beginner*, I have not miſs'd of my Deſign.

Farewell.

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THE

THE Introduction.

Anatomy what.

ANATOMY *is the artificial ſeparation of the Parts of the Body by ſection, inſtituted for the attaining to the knowledge of its Frame, and the uſe of each Part.*

Its Subject,

All animal Bodies of convenient bulk, are the *Subject* of Anatomy: But an humane Body is the primary, both becauſe its frame is more perfect and exquiſite than that of any other, and becauſe the Anatomiſt diſſects others, to the end only that by comparing thoſe with this, he may obtain a more accurate knowledge of it, the preſervation and cure whereof is the principal and ultimate *End* of Anatomy.

and End.

This Art being ſo noble for its *Subject*, and ſo beneficial for its *End*, as many as have taken pains in cultivating of it, have deſerved very well of Mankind: for Skill therein, as it is very pleaſant and ſatisfactory unto all, ſo is it abſolutely neceſſary for ſuch as take upon them to adminiſter Medicin, or practiſe Chirurgery. But the *Minima* or ſmalleſt particles, whereof the parts of our Bodies conſiſt, being ſo very fine, that many of them cannot be diſcovered by the naked eye, and ſome deny to ſhew themſelves to the beſt Glaſſes that have yet been invented, 'tis no wonder that there have been and ſtill continue various Opinions concerning the nature of ſeveral parts, and conſequently of their actions and uſes, and the manner and reaſon of them. But the unwearied diligence of ſome later Anatomiſts hath brought many things to light, wherein all Antiquity was miſtaken; whoſe diſcoveries, collected with the greateſt care, I ſhall inſert (with due commemoration of the Authors) in their proper places in this Treatiſe. Before our entrance whereupon, I think it neceſſary, by way of Introduction, firſt to explain to the young Student in Anatomy, what thoſe ſimilar parts are that the bulk of the Body conſiſts of; that when diſſimilar parts which conſiſt of them, are deſcribed, he may the better underſtand what is ſaid.

The Fabrick of the Body conſiſts of parts ſimilar and diſſimilar.

Similar parts what.

And firſt we muſt explain what is meant by *ſimilar* and *diſſimilar* parts. A *ſimilar* (otherwiſe called a *ſimple*) part, is that which tho' it be cut or divided into ſeveral pieces, yet they will be all of the ſame nature, ſubſtance and denomination with one another, and with the whole: as every portion or particle of a *Bone* (v. g.) is *Bone*. A *diſſimilar* (otherwiſe called a *compound*, and an *organical*) part, is that whoſe portions are neither of the ſame ſubſtance, nor denomination; as *(v.g.)* a *Finger*, which conſiſts of the skin, fleſh, bone, *&c.*

Diſſimilar what.

Of this latter kind of parts, this is no proper place to treat: And as concerning the former, the Reader muſt underſtand, that tho' they be called ſimple or ſimilar, 'tis not meant that they are *truly* ſo: (for there are none amongſt thoſe we term ſo, whoſe leaſt particles are not of different natures and kinds;) but that they appear ſo to the more ſuperficial and ſlight view of the Anatomiſt;

and to diſtinguiſh them from the compound or diſſimilar parts, whoſe diverſity of ſubſtance the eye at the firſt glance diſcovers.

Similar parts are Ten.

Theſe ſimilar parts are commonly reckon'd to be Ten, *viz.* the *Skin*, a *Membrane*, *Fleſh*, a *Fibre*, a *Vein*, an *Artery*, a *Nerve*, a *Ligament*, a *Cartilage*, a *Bone*. Theſe are common to the whole Body, there being no diſſimilar or organical part which does not conſiſt of ſeveral of them. There are beſides theſe, other parts which may be called ſimilar as to their ſubſtance, but becauſe they are proper only to ſome particular part, 'twill be more convenient to treat of them when we come to ſuch part, and therefore we ſhall omit to ſpeak of them here, and confine our ſelves to the parts mention'd.

I. *The Skin.*

The word *Skin*, tho' in a large and vulgar acception it be applied to the Membranes of the Muſcles, &c. (as we commonly ſay ſuch a piece of fleſh is *skinny*) yet Anatomiſts underſtand it only of the outward integument or cover of the Body, which the *Latins* term *cutis*.

II. *A Membrane.*

The word *Membrane* is a common appellation to all the coverings that inveſt the ſolid parts of the Body, or contain the fluid humors. Thus the Bones, Muſcles, Brain, &c. are cloathed with membranes; and the gall, humors of the eye, &c. contained in them.

III. *Fleſh, four ſorts of it.*

Fleſh is an uncertain term, unleſs ſome reſtrictive explication be added to it, to limit its being meant of this or that particular ſort of fleſh; there being four ſorts of it, *viz.*

1. *Muſcular.*

1. That of the *Muſcles*, which moſt properly bears the name; and comprehends all the red, ſolid (yet ſoft) ſubſtance, that the bulk of the Body chiefly conſiſts of; which ſhall be further deſcribed in the fifth Book.

2. *Viſcerous.* 2. That of the *Viſcera* or *Bowels*, *viz.* of the Liver, Spleen, and Kidneys, of which in the firſt Book.

3. *Membranous.* 3. *Membranous* fleſh, that namely which is partly membranous, and partly fleſhy, as the ſubſtance of the Gullet, Stomach, Inteſtins, Womb, Bladder, and the *Membrana carnoſa* (ſo called) it ſelf; of all which more afterwards in their proper places.

4. *Glandulous.* 4. That of the *glands* (or kernels.)

Glands of two kinds. Theſe in reſpect of their *conformation*, are uſually divided into *conglobate*, and *conglomerate*; and have a different *uſe* the one from the other. *1. Conglobate.* 1. The *conglobate* are ſmooth in their ſurface, and are made up of one continued ſubſtance as it were: the *uſe* whereof is to ſeparate the *lympha* from the arterial blood, and to remand it by the Lympheducts, either into the chyliferous, or ſanguiferous veſſels (only thoſe in the Meſentery, as likewiſe thoſe in the Breaſts of Nurſes, do miniſter to the chyle, as well as to the *lympha.*) *2. Conglomerate.* 2. The *conglomerate* are ſomewhat uneven in their ſurface, and conſiſt each as it were of many leſſer glands: and their *uſe* is, to ſeparate from the blood, and alſo to elaborate and alter ſeveral ſorts of juices, and then by one or more proper ducts to convey the ſame into peculiar cavities. As the *Parotides* and maxillar glands convey the *ſaliva* into the mouth by their ſalival ducts, *&c.*

IV. *A Fibre.* A *Fibre* is defined by Dr. *Gliſſon* (in *cap.* 4. *de Ventric.*) to be *a body in figure like a thread, ſlender, tenacious, tenſile, and irritable, made of ſpermatical matter, for the ſake of ſome motion and ſtrength.* They are of two ſorts, *fleſhy*, and *nervous:* the firſt conſtitute a great part of the Muſcles, and are the main inſtruments of motion; the latter run through, and are interwoven in the nervous parts, and are the principal organs of ſenſe: being otherwiſe called *membranous* fibres, when they are interwoven in membranes.

V. *A Vein.* A *Vein* is a ſanguiferous veſſel, whoſe larger branches in the habit of the body, eſpecially in the limbs, run next under the skin, and both there and alſo in the Venters (*viz.* belly, breaſt and head) ſerve to convey back again towards the heart, that blood which was ſent from thence by the Arteries into the reſpective parts. They are of a thinner ſubſtance and looſer texture than the Arteries: and of a like nature with them are the milky veins that convey the chyle, and alſo the peculiar ducts that diſcharge the particular humors from the conglomerate glands; and ſomewhat finer than they, are the Lympheducts that return the *Lympha* ſeparated from the arterial blood by the conglobate glands.

VI. *An Artery.* An *Artery* is alſo a ſanguiferous veſſel, and generally holds the ſame courſe with a Vein, but lies deeper. It can no where be ſeen in the ſurface of the body, but may be felt to beat in ſeveral parts at the ſame time with the heart, and its pulſe is chiefly indicative of the temper of the blood, but partly alſo of the vigor or defect of ſpirits. Its coat is ſtronger and more fibrous than that of a Vein. Its uſe is, to convey blood and vital ſpirit into all the parts, for their nouriſhment, and the conſervation of their innate heat.

VII. *A Nerve.* The *Nerves* are veſſels taking their origine from the medullar ſubſtance of the brain (taken largely) and the ſpinal marrow, conveying thence animal ſpirits into all the parts, for their ſenſe and motion reſpectively. They are without any ſuch ſenſible cavity or humor flowing therein, as the Veins and Arteries have, and conſiſt of a double coat derived from the two membranes that cloath the brain, and a medullar ſubſtance contained therein. Their diviſions and diſtributions do not correſpond with thoſe of the Veins and Arteries, nor have they one common trunk from whence all the reſt are propagated, as thoſe have, but ſpring each from its particular root; unleſs one will call the *medulla oblongata* continued into the *ſpinalis*, a Nerve, and ſo make it the common trunk.

VIII. *A Ligament.* A *Ligament* is a part of a middle ſubſtance betwixt a Cartilage and a Membrane, appointed for the tying of ſundry parts together. Thoſe which tye the bones to one another are void of ſenſe, but thoſe that knit other parts together are (dully) ſenſible.

IX. *A Cartilage.* A *Cartilage* (or Griſtle) is of a middle ſubſtance betwixt a Ligament and a Bone. It is flexible, but inſenſible: and by the drying up of its moiſt glutinous particles, in age it often degenerates into bone: whence, in a great meaſure, is the ſtiffneſs in the joints of old men, moſt of the ends of the bones in their articulations with one another being tipped with cartilages.

X. *A Bone.* A *Bone* is a very dry, cold and hard part, inflexible, void of ſenſe, affording ſtabiliment and form to the whole body. Some bones are more ſpongie and porous, and others more ſolid. Others again have large cavities, filled with marrow; others none. But of theſe, and all the other ſimilar parts, more in their proper places.

Thus much I thought good to premiſe by way of Introduction, to make the Reader more capable of receiving both delight and benefit in peruſing this Anatomical Treatiſe, to which I now proceed.

The

The First Book.

OF THE LOWEST CAVITY, CALLED ABDOMEN.

CHAP. I.

Of the Diviſion of the whole Body, and of its Parts.

The Body conſidered in two reſpects.

AN humane Body may be conſidered either *generally*, with reſpect to the *whole*; or *particularly*, with reſpect to each *part* of which it conſiſts.

1. Generally.

In its *general* conſideration there are to be taken notice of, its external form or ſhape, its bulk, and its colour. But theſe Accidents being obvious to the eye of every man, as well as to the Anatomiſt's, are no proper ſubjects for our diſcourſe.

2. Particularly.

The *particular* conſideration of it obſerves and demonſtrates the figure, connexion and compoſition or ſtructure of each ſeveral *part*, and the great diverſity of their actions and uſes.

The diviſion of the whole Body.

The *whole* Body is divided into the *Trunk*, (containing three *Venters*) and the *Limbs*. The three *Venters* are the Cavities of the *Abdomen* or Belly, the Cheſt, and Head. The *Limbs* are the Arms, Thighs and Legs.

A Part defined.

A *Part* may be thus defined, *viz. It is a bodily or ſolid Subſtance, cohering with, making up, and partaking of the life of, the whole, and ſerving for ſome function, or uſe.*

In this definition are implied theſe five things.

1. A part muſt be *ſolid*, whereby the ſpirits and humors are excluded.

2. It muſt *cohere* with the whole, that is, be not only contiguous, but continuous to it: and from hence alſo the ſpirits and humors are excepted, as only touching the ſides of the veſſels as they paſs along, being contained in them, but not united to them.

3. It (with others) muſt ſerve to *compleat* or *make up* the whole. Whence the child in the womb is not to be reckoned a part of a pregnant woman, though it be knit to her womb by the Navel-ſtrings (the *placenta* intervening) becauſe after delivery ſhe remains a perfect woman, as ſhe was alſo before conception.

4. It muſt partake of the *life* of the whole: whereby the nails and hairs are exempted, which have only a vegetative, but no animal life.

And 5. It muſt have ſome *function*, or *uſe*: ſo that preternatural excreſcencies, as Warts, &c. are not to be reputed parts, (being alſo excluded by the third head, as contributing nothing to the perfection of the whole.)

Having mentioned the *function*, and *uſe* of a part, it will be convenient to explain what is meant by them, and to diſtinguiſh them.

The function *of a part what. It is twofold, private and publick.*

The *function* (or *action*) of an (organical) part, is *a certain effective or operating motion produced by it, from its own proper aptitude.* And is either *private*, or *publick.* By the *private* action the parts only provide for themſelves; but by the *publick*, for the whole animal. As for inſtance: The ſtomach by a *private* action converts the blood that is brought to it by the Arteries, into its own nouriſhment: But by its *publick* action, which is Concoction, or turning the food into Chyle, it provides for the whole body.

The uſe *of a part what, and wherein it differs from the* action.

The *uſe* of a part is that aſſiſtance which the leſs principal parts afford to the principal one in performing its action. And it differs from the *action* of a part in *two* reſpects. *Firſt*, In that thoſe parts only are ſaid to have an *action*, which operate; whereas many have an *uſe*, which act nothing at all themſelves, but only accommodate and aſſiſt thoſe that do act. Thus the Fat has no *action* of its own, but it is *uſeful* to cheriſh and moiſten the Muſcles, *&c.* that their motion or action may be performed more glibly and eaſily. *Secondly*, An *action* belongs to or proceedeth from the *whole* organ that operates; but every *particular* part that makes up the organ, hath an *uſe*. Thus the *whole* Muſcle exerts its *action*, which is contraction: But the ſeveral *parts* of which a Muſcle conſiſts, have *each* of them their *uſe* to aſſiſt this action; as, the membrane that inveſts it, is of uſe to incloſe and contain its fibres, and to diſtinguiſh and keep it apart from other Muſcles; the uſe of the Nerve is to bring it animal ſpirits; of the Artery, to ſupply it with blood, *&c.* But becauſe the *action* of a leſs principal part, may be of *uſe* to further that of one more principal; as alſo becauſe the *action* of *ſeveral* organs may conſpire to *one uſe* (as the Muſcles of the *Abdomen*, to the excluſion of the excrements) therefore *action* and *uſe* are often confounded,and uſed the one for the other by Anatomiſts; nor ſhall we everywhere in the following Tract diſtinguiſh them ſo nicely.

The diviſion of the parts.

The *parts* of the *body* have a *twofold* difference or diſtinction; the one from their *matter*,and the other from their *function*, or *end*.

1. From their matter.

In reſpect to the *matter* of which they conſiſt, they are divided into *ſimilar* and *diſſimilar*,of which we have treated fully enough before in the *Introduction.*

2. From their function, *or* end, *viz. into* organical,

In reſpect of their *function*, or *end*, they are divided into *organical*, and *non-organical*.

An *organical* part is that which is deſigned for performing ſome action. Such as are chiefly the *diſſimilar* parts; but yet ſome of the *ſimilar* may be alſo termed *organical:* as for inſtance,a Nerve, which conveys and diſtributes the animal ſpirits; and likewiſe the Arteries and Veins,which do the ſame to the blood.

and non-organical:

A *non-organical* part is that which has only an uſe, and no action: as a griſtle, fat, *&c.*

as alſo into principal,

Again in reſpect of their *function*, or *end*, the parts are divided into *principal*, and *miniſtring*.

A *principal* part is that which performs the moſt noble and principal action, and from which the actions of many other parts proceed,or are aſſiſted. Of which ſort are, 1. The *Heart*, which is the (diſtributing) fountain of vital heat, and nutritive blood, communicating both to all the other parts, by its continual pulſation. 2. The *Brain*, which is the fountain of the animal ſpirits, and ſo the Author of all ſenſe and motion. To theſe ſome add, 3. the *Genitals*, on which the preſervation of the *Species* depends; as on the other, that of the *Individual*.

and miniſtring.

A *miniſtring* part is that which miniſters to or aſſiſts the principal: ſuch as are the Stomach, Liver, Reins, the Hand, *&c.* And of theſe ſome are *neceſſary*, others *not*.

The miniſtring *are either* neceſſary, *or* not neceſſary.

The *neceſſary* are thoſe without which a man cannot live. Such as are the Stomach, Liver, Lungs, *&c.*

The *not neceſſary* are ſuch as contribute to the well-being, but are not abſolutely neceſſary to the life of a Man: as an Hand, a Leg, ſimple fleſh, which in conſumptive perſons is almoſt wholly ſpent.

There are alſo other diviſions of the parts of the Body, as into parts *containing*, parts *contained*, and the *ſpirits*, expreſs'd by ὁρμῶντες, or *impetum facientes*, by *Hippocrates*.

Fernelius divides the Body alſo into *publick*, and *private Regions*. The *private* are ſuch as the Brain, Reins, Womb, *&c.* The *publick* are Three. The firſt includes the *Vena portæ*, and all the parts whither its Branches reach. The ſecond begins at the roots of the *Cava*, and ends in the ſmall veins before they become capillary. The third contains the Muſcles, Bones, and the bulk of the Body, and is terminated by the Skin. But this diviſion is only of uſe in Medicin.

CHAP.

CHAP. II.

Of the Circumſcription, Regions, and Parts of the Abdomen.

IN the former Chapter we divided the *Whole* Body into the *Venters*, and *Limbs*. Of which, becauſe the Venters are more ſubject to Putrefaction, as containing parts that are very moiſt and flabby, whereas the Limbs conſiſt of parts that are more dry and firm, ſuch as the Bones, Muſcles and Tendons; I ſay, on this account, the Venters are uſually firſt diſſected, and of them firſt of all the *Abdomen* or Lower Belly that contains the Guts, which, of all other parts, are apteſt in a ſhort time to ſend forth noiſome ſmells, and to be offenſive to the Anatomiſt. We ſhall begin with *it* therefore, and in the ſecond place proceed to the middle Venter or *Cheſt*, and laſt of all to the *Head*: making each of theſe the ſubject of a particular Book.

Before we begin to cut open the *Abdomen*, three things are to be conſidered in relation to it. Firſt, Its *Circumſcription* or *Bounds*. Secondly, Its *Regions*. Thirdly, The ſpecial or conſtituent *Parts* of it.

The Circumſcription of the Abdomen.

As concerning the *Circumſcription* of it, its *upper* part is ſevered (within) from the Breaſt by the Midriff. In the *foreſide* it is bounded *above* by the *Cartilago enſiformis*, or the Heart-pit, and *beneath* by the Share-bones. On the *ſides*, by the ſhort Ribs, and *Oſſa Ilia*, or Hip-bones. *Behind*, by the *vertebræ* of the Loins, *Os Sacrum*, and the *Coccyx*.

Its Regions.

1. Anterior.

Its *Regions* are either *Anterior*, or *Poſterior*. The *Anterior* (which comprehends alſo the *Lateral*) is ſubdivided into three others, *viz.* the uppermoſt, middle, and loweſt.

The *uppermoſt*, which reaches from the *Cartilago enſiformis* to within three inches above the Navel, (parallel to the loweſt of the ſhort Ribs) hath three *parts*. Two *lateral*, which are called *hypochondria*, or *ſubcartilaginea*, becauſe they lie under the Cartilages of the ſhort Ribs. In the right *hypochondrium* lieth the greateſt part of the Liver, and part of the Stomach; and in the left, the Spleen, and a greater part of the Stomach. The third part is that which lieth *before*, between the two lateral parts, and is properly called *Epigaſtrium*, becauſe the (middle of the) *Stomach* lieth *under it*. In this part remarkable is the Pit of the Breaſt, which formerly has been uſed to be called καρδία, but *ſcrobiculus cordis* by the modern Writers.

The *middle* Region extendeth it ſelf from three inches above the Navel, to three inches under it. The *forepart* is that where the Navel is, from whence it is called *Regio umbilicalis*. The two *lateral* parts are called in Engliſh the *Flanks*; in Latin *Ilia*; by *Ariſtotle* λαγόνες, either from their *laxity* or ſoftneſs, or from λαγνεία, *ſalacitas*, as if they were the ſeat of *Luſt*; by *Galen* κενεῶνες, becauſe being placed between the *Oſſa Ilia*, and Ribs, they are lank, and ſeem *empty*. They are called by Dr. *Gliſſon*, *Epicolicæ*, becauſe on each ſide, this Region inveſteth the lateral parts of the Gut *Colon*.

The *loweſt* Region is called ὑπογάστριον, *hypogaſtrium*. This Region reacheth from three inches below the Navel, to the *Os Pubis* and Groins, and hath three parts; two *lateral*, and one *anterior* or middle. The *lateral* are bounded by the *Oſſa Ilia*, ſo called, becauſe a great part of the *Ilium inteſtinum* lieth under them on each ſide. Beſides this, in the right lateral part are placed the beginning of the *Colon*, and all the *Cæcum inteſtinum*. In the left are contained the ending of the *Colon*, and beginning of the *inteſtinum Rectum*.

The *forepart* of the *Hypogaſtrium* by *Ariſtotle*, *lib.* 1. *Hiſt. animal.* 3. is called ἦτρον, by ſome (in ſpecial) *Abdomen*. At the lower part of it is ſeated the *Pubes*, which in the adult or ripe of age is covered with hair; and on each ſide of this, the Groins, called Βουβῶνες, or *Inguina*. Within this forepart of the loweſt Region, are contained part of the Meſentery and ſmall Guts, the Bladder, and in Women the Womb.

2. *Poſterior.*

The *poſterior* Region is divided into two parts, the upper and lower.

The *upper* is called the *Region of the Loins*, reaching from the root of the Midriff to the top of *Os ſacrum*, and contains within it the Kidneys, the *Pancreas Aſellii*, and Centre of the Meſentery, the Receptacle of the Chyle, and the deſcending trunks of the *Cava* and *Aorta*.

The *lower* part of the hinder Region reaches from the top of *Os ſacrum*, to the lower end of the Rump-bone or *Coccyx*. It is much broader above than below, and within it are included the ſtraight Gut, part of the Ureters, and in Women the Teſticles or *Ovaria*, &c.

Its parts.

The *parts* of the *Abdomen* are *containing* (or outer;) and *contained* (or inner.)

Containing,

The *containing* parts are ſuch as are either *com-*

mon to it with the reſt of the Body; or are *proper* to the *Abdomen* alone.

and contained.

The parts *contained* ſerve either for *concoction*, for *ſeparation of excrements*, or for *generation*. Of all which in order, and firſt of the *common containing* parts.

CHAP. III.

Of the common containing parts of the Belly.

The common containing parts of the Belly.

THE *common containing* parts of the Belly are five, the *cuticle* or *ſcarf-skin*, the *skin*, the *fat*, the *membrana carnoſa*, and the *common membrane* of the Muſcles.

1. Cuticula, or *ſcarf-skin.*

The *ſcarf-skin*, in Greek is named ἐπιδερμὶς, ὅτι ἐπὶ τὸ δέρμα τίθεται, *becauſe it is placed upon the true skin* as a covering. It is as large as the true skin, and more compact; for the ſerous humor that in *puſtules* and bliſters ouzes through that, is ſtopt by the denſity of this. Yet it is full of pores, for the evacuation of ſweat, and exhalation of vapors. It has neither blood-veſſels nor nerves diſperſed through it, and therefore is void of ſenſe.

Its matter.

It is bred of a viſcous and oleous vapour of the blood, raiſed and exhaled by the natural heat of the ſubjacent parts, and dried and condenſed by the external cold, as moſt Anatomiſts have taught; but Dr. *Gliſſon* thinks it to be a ſoft, ſlippery, viſcid and tranſparent juice (like the white of an Egg) iſſuing out of the capillary extremities of the nerves, which end in the outward ſuperficies of the true skin, where it is coagulated, and by its viſcoſity ſticketh upon it like glue; ſo that it can hardly be ſeparated therefrom by a knife, but may eaſily by a veſicatory. It ſometimes alſo almoſt wholly peels off in Scarlet or burning Fevers, and the Small-Pox; but a new one preſently ſucceeds it. *Diemerbroeck* thinks, it is bred neither of theſe ways, but has a ſeminal principle as well as the skin it ſelf, or any other ſolid part. But not ſo probably, ſeeing it has no ſenſe, and may be *often* quite loſt, and yet preſently regenerated: *all* which circumſtances agree to no part that has a ſeminal principle. And whereas he objects, that becauſe Infants when they are born have a ſcarf-skin, therefore it cannot be bred by condenſation, ſeeing there is neither cold nor drineſs in the womb, but on the contrary warmneſs and moiſture, which will hinder all condenſation; Dr. *Gliſſon* ſolves this Objection, by ſhewing how a Liquor may be condenſed or indurated two ways; the *one*, by ſeparation of the thinner parts by way of exhalation, which is properly called *deſiccation*, and this he confeſſes cannot happen in the womb; the *other*, by *coagulation*, that is, by ſeparating the more ſerous part of the matter from the thicker particles; which ſort of condenſation may take place well enough in the womb. See his *tract. de ventric.* &c. *p.* 11, 12. where he very clearly makes this out.

Some, from their obſervations by their Microſcopes, affirm the Cuticle to be ſcaly, like that of Fiſhes: But ſeeing it is ſo denſe as to contain the *ſerum* in raiſing of bliſters, (as well as for other reaſons) 'tis very improbable that 'tis of that texture, though perhaps its outer ſurface may appear ſo.

The

Uſes. The *uſe* of it is, Firſt, To defend the Skin, (which is of an exquiſite ſenſe) from external immoderate either heat or cold. In cold weather its pores are ſo ſtraitned, that the more tender parts lying under it are not too much affected with the cold: In hot weather by its compactneſs it hindreth too great perſpiration.

Secondly, To be a *medium* between the Skin and the object to be felt; for when it is rubb'd off, the true Skin cannot endure the touch of other Bodies without pain.

Thirdly, To hinder the ſerous humour from iſſuing from the Arteries; for this we ſee to happen when the *cuticula* is rubbed off by any means.

Fourthly, To make the Body more beautiful; which it does by ſmoothing the aſperities of the true Skin, and inducing a comely colour of white and red. Whiteneſs is natural to this part, and the redneſs is owing to the blood that is affus'd to the outward ſuperficies of the true Skin; which being ſeen through the Scarf-skin makes that florid colour.

2. Cutis, or the true skin. Next under the Cuticle lieth the *true Skin*, which is five or ſix times thicker than it. In Greek 'tis called δέρμα, or δέρις, either from δέρω, to *fley*, or *q.* τέρμα, becauſe it is the *end* or ſuperficial *boundary* of the body.

Its Colour. It is naturally *white*, as other membranes: but in living and healthful perſons, and ſuch as live in a temperate or ſomewhat cold climate, from the afflux of the blood towards it, and the colour of the ſubjacent parts, it is of a reddiſh roſie colour. But in thoſe that live under the Æquinoctial Line and in exceſſively hot Climates it appears black: Not but that both it ſelf and alſo the Cuticle are truly white in them as they are in the Europeans; but, as *Malpighius* probably conjectures, it appears of that hue from the blackneſs of that mucous and reticular body which lies betwixt it and the Cuticle.

Matter. It is made up of *nervous fibres* very cloſely interwoven one with another, and of a *parenchyma* that fills up the interſtices and inequalities thereof. That it has ſuch a *parenchyma* may appear by this, that when a Sheep-skin (for inſtance) has been ſome while ſteept in water, one may with an ivory knife or the like ſcrape a great deal of mucous ſlimy matter off it, whereby it becomes much lighter, thinner and in ſome meaſure tranſparent, as we ſee in Parchment. Moreover, according to *Malpighius*, it is beſet with innumerable pyramidal *papillæ*, whoſe heads jet out of its ſurface, but are covered by the Cuticle: which *papillæ* he is inclined to believe to be the ends of the Nerves perforating the skin, and not raiſed from the skins proper ſubſtance. And amongſt them, he ſays, there is ſpread over the ſurface of the skin, a certain mucous and reticular body with holes in it for the emerſion of their heads, and alſo for the paſſage of the Sweat-veſſels. Theſe Sweat-veſſels ariſe from the glands that the skin is every where beſet with, and convey out that ſweat that is ſeparated from the Arteries in the glands.

Difference of thickneſs. The Skin in the Forehead and Sides is thin, thinner yet in the palm of the Hand, but thinneſt of all in the Lips. In the Head, Back, and under the Heel it is thickeſt. It is thinner in Children and Women than in Men; and in thoſe that live in hot Countries, than thoſe that live in cold. And this (as *Spigelius* obſerves) is the reaſon why thoſe that are born in cold Countries, when they come under the Æquinoctial Line, are often taken with Fevers, becauſe that great heat that is there excited in the Body by the outward air, cannot exhale through the too thick Skin; but being retained induces a preternatural heat, and ſo a Fever.

Pores. It is full of *Pores*, as well as the *cuticula.* For thoſe who deny them, oppoſe not only reaſon, but ocular demonſtration. The paſſing of Quickſilver through a Sheep-skin evidences this; and Mr. *Boyle* has tryed the ſame in a piece of the skin of a Man's arm. And any one may ſatisfie himſelf by an ordinary Perſpective, or but a good pair of Spectacles, of the ſame. For if when he is ſweaty, he wipe off the ſweat from the tips of his fingers, he may plainly ſee freſh ſweat iſſue out by the pores, and ſtand in little drops.

Temperature, and veſſels. It is of a moſt exact *temperature*, neither too cold nor too hot, that it might the more accurately judge of the temperature of tangible things. Its *nervous* part, which is naturally cold, is attemper'd by the heat of the arterial blood that flows continually for the ſupply of its parenchymatous part: and its *parenchyma* is not heated too much by the afflux of the blood, becauſe it is lodged amongſt ſo numerous cold nervous fibres. It has very many both capillary *Arteries* and *Veins* diſtributed through it; as alſo abundance of *nervous* twigs, which endue it with a moſt exquiſite ſenſe.

Hair. As for the *hair* that in many places grows out of the skin, we ſhall defer our diſcourſe of it, till we come to treat of the hair of the Head, in Book III. chap. 2.

Action. Its *action* is ſenſation or feeling. Which action is chiefly performed by thoſe fore-mentioned pyramidal *papillæ* which *Malpighius* by the Microſcope has obſerved to ariſe out of it, in greater plenty in ſuch parts as are of more exquiſite ſenſe, as the palm of the hand, ſoal of the foot, *&c.* but in leſs, in ſuch as are of a more dull.

Uſes. Its *uſe* is, Firſt, to cloath the whole Body, and defend it from the injuries of the weather, *&c.* Secondly, To be a general vent or emunctory to the Body, by which all its exhalations may fitly tranſpire. Which whether it be done only through its pores, as moſt Anatomiſts have affirmed; or alſo through its very ſubſtance, as Dr. *Gliſſon* has of late aſſerted, is a controverſie hardly worth the inſiſting on.

Laſtly, In ſeveral places of the body to put forth and nouriſh the hair, for the fence and ornament of the reſpective parts.

3. *Fat.* Next under the Skin lies the *Fat*, which is commonly taken to be a covering diſtinct from the *membrana carnoſa* that lies under it, having the name of *membrana adipoſa* given it; but Dr. *Gliſſon* reputes it only a part of the *carnoſa*: for he ſays, that membrane in its outer part is full of membranous cells, which are fill'd with a yellowiſh fat, ſomewhat like as the cells in the pulp of an Orange are filled with its juice. *Malpighius* ſays, "the Blood-veſſels are expanded "like the boughs of trees, every where through "the membrane that lies under the Fat, and the "membranous cells full of fatty globules hang "upon their ends, like leaves upon the boughs of "trees. The cells are of almoſt an oval figure, "and are like the lobules of which the Lungs are

“ compoſed, or rather like a conglomerate gland.
“ They are knit to one another by the mem-
“ brane out of which they are formed. And
“ through the ſame membrane and cells, he ſays,
“ do not only capillary Veins and Arteries, but
“ *ductus adipoſi* alſo run, which ſwell with fat,
“ eſpecially if they be beheld in an Animal newly
“ kill'd. Whether theſe veſſels, *adds he*, propa-
“ gated through all the fat that is placed in the
“ circumference (or *ambitus)* of the body, flow
“ from the Caul, as from their root, ſenſe has
“ not as yet diſcover'd: But ſeeing the Caul is
“ knit to the back, as to the centre of the whole
“ body, it does not ſeem unlikely but that they may
“ be propagated into every region of the body,
“ by means of the *membrana adipoſa* that is ex-
“ tended over all: as we obſerve of the Lym-
“ pheducts, though they want any notable and
“ common trunk.” Thus far he.] Whether we ſhould call it *Fat*, or the *fatty membrane*, is not worth the while to diſpute: nor much matters it, whether we repute the Fat, and ſubjacent membrane, for one or two integuments. Let every one enjoy his opinion. For my ſelf, I chuſe rather to diſtinguiſh them, and conſider them apart.

Its definition. *Fat* is defined to be *a greaſie ſubſtance, bred of the oily portion of the aliment and blood, condenſed by cold.*

Situation. In Men it is *placed* next under the skin, and that all the Body over, except in the Lips, the upper part of the Ear, Eye-lids, Cod and Yard, which have no fat at all; and in the Forehead, where the skin cleaveth cloſe to the carnous membrane, as alſo, according to ſome, in the Temples. It is collected in the cells before-mentioned, and according to the common opinion is bred of an oily portion of the blood ſweating like a dew out of the Veins, and afterwards concreting: but according to *Malpighius*, the *vaſa adipoſa* are the conduits of its matter, as ſhall be further ſhewn in Chap. 5. of the *Omentum* or Caul.

This Fat is properly called *pinguedo*, whereas that of the Caul, *&c.* is called *ſevum*, Suet or Tallow. And they differ in this, that *pinguedo* is eaſily melted, but not ſo eaſily congealed; whereas *ſevum* is not eaſily melted, but is eaſily congealed. Beſides, *pinguedo* is not brittle, but *ſevum* is.

The *uſes* of it are theſe; Firſt, It defendeth the Body from the external air.

Secondly, It preſerveth the natural heat.

Thirdly, It furthereth beauty by filling up the interſtices of the Muſcles and wrinkles of the Skin; whence very lean people for want of it look ſhrivel'd and deformed.

Fourthly, By filling up the empty ſpaces between the Muſcles, it rendreth the motion thereof more glib and eaſie, (ſo it do not abound too much) and keepeth all the parts from drineſs, or breaking. Hence it beſmears the extremities of the Cartilages, the jointings of the greater Bones, and the Veſſels that they may paſs ſafely.

Laſtly, *Malpighius*, rejecting all theſe uſes as primarily intended, thinks the principal uſe of it, whilſt it is mixed with the blood, is to be a continual *pabulum* (or food) of the natural heat, whereby the vital flame (and conſequently heat) is perpetuated. Alſo to mitigate the acrimony of the blood, and join and unite the ſaline particles thereof ſo as that they become aſſimilable to the ſolid parts for their nutriment, ſerving to thoſe particles as oil to colours in painting, or lime to ſtones in building. When it is ſeparated from the blood, and collected here or otherwhere, he is inclin'd to the common opinion, that in caſe of famine it paſſes into the nouriſhment of the body. But as to its more ordinary uſe when collected in particular parts, the Reader may find it where thoſe parts are treated of.

4. Membrana carnoſa.

The *Carnous membrane* is only *properly* ſo called in Brutes, in whom it is truly *fleſhy* and muſcular, ſo that by means hereof they can at pleaſure move and ſhake their skin which is contiguous to it, no fat intervening between them: But in Man, ſeeing it has no carnous fibres, or *parenchyma*, it is very improperly termed *carnous.* We ſhewed juſt now Dr. *Gliſſon*'s opinion to be, that it is not truly diſtinct from the *Fat*, but the Fat is a part of *it:* and upon account of the fat that adheres to it, he thinks it deſerves the name of *adipoſa* rather than *carnoſa*. Only in the Forehead and Neck it looks ſomewhat fleſhy, and therefore may in thoſe places with better reaſon be called ſo.

Its Uſe.

The *uſes* that we aſcribed to the *fat* agree alſo to this membrane, *viz.* to defend the body from external cold, and to preſerve the natural heat, *&c.* yea it ſerves alſo to ſuſtain and ſtrengthen the veſſels that paſs betwixt the skin and muſcles between which it is placed. Some make this membrane the ſeat of that *horrour* or ſhivering that happens in the beginning of Ague-fits, ſuppoſing it to be of exquiſite ſenſe, and that it is then twitched by ſharp humours. But I think that ſymptom rather proceeds from the like affection of the membrane next under it, which is

5. The common membrane of the Muſcles. The *common membrane of the Muſcles.* This is ſpread over all the body (except the skull, according to ſome) and is knit by fibres ſomewhat looſely both to the foregoing that lies above it, and to the proper membrane of each Muſcle that lie under it. It is very thin, but ſtrong: It is not yellow like the former, but whiter and more tranſparent.

Its Uſe. It ſerves as a common bag to contain the Muſcles in, and helps to keep them in their proper places.

CHAP. IV.

Of the proper containing parts.

The proper containing parts of the Belly. THE *proper containing* parts are the *Muſcles* of the Belly, and the *Peritonæum.*

1. The Muſcles. As to the *Muſcles*, ſeeing we have aſſigned a particular Book (*viz.* the fifth) for the deſcription of all the Muſcles of the Body, we ſhall refer the Reader thither for theſe of the *Abdomen*, where he may fi[illegible] them fully deſcribed *chap.* 17. and at preſent content our ſelves with on[illegible]ming of them. There are *five* pair of them: The outermoſt are the *Obliquely deſcending*; the next, the *Obliquely aſcending*; the third, the *Recti*; the fourth, the *Pyramidal*; and the inmoſt, the *Tranſverſe.* All which being removed, the *Peritonæum* appears next.

2. The Peritonæum. The *Peritonæum* or inmoſt inveſting coat of the Belly, commonly called its *Rim*, (derived from περιτείνω, from its office of *encompaſſing*) adheres *above* to the Midriff, *below* to the Share- and Flank-bones; in the *fore-part* firmly to the tranſverſe Muſcles, but chiefly to their Tendons about the *Linea alba*; *behind* to the fleſhy heads of theſe Muſcles looſely. The end of this connexion is both for its own ſtrength, and that it may the better comply with and ſerve the Muſcles in their compreſſion of the Belly.

Its figure and ſubſtance.

Its *figure* is oval; and its *ſubſtance* membranous. The inner ſuperficies of it, which reſpects the Guts, is ſmooth, equal, and ſlippery, bedewed with a kind of watery humour contained in the *Abdomen*: but the outer ſuperficies, whereby it cleaves to the aforeſaid Bones and Muſcles, is rough and unequal.

Origine.

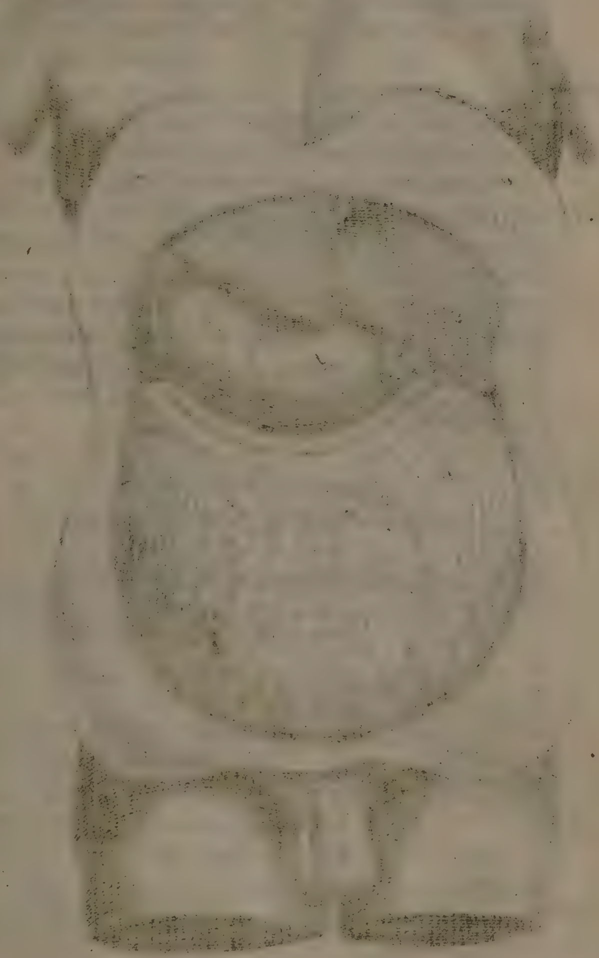
As for the *origine* of it, *Fallopius* will have it to proceed from the ſuperiour and inferiour *plexus* of Nerves of the *Abdomen*; for from them it cannot be ſeparated without tearing. To him Dr. *Gliſſon* aſſents. Some derive it from the Ligaments by which the *vertebræ* of the Loins, and of *Os ſacrum* are knit one to another, eſpecially from thoſe of the firſt and third of the Loins, becauſe it is there thickeſt. *Diemerbroeck* denies it to have any origine at all, other than the firſt ſeminal matter out of which it was formed in the womb. But that is only its *material* principle, and hinders not but that it may have (according to Dr. *Gliſſon*'s diſtinction) a principle or origine of *continuation*.

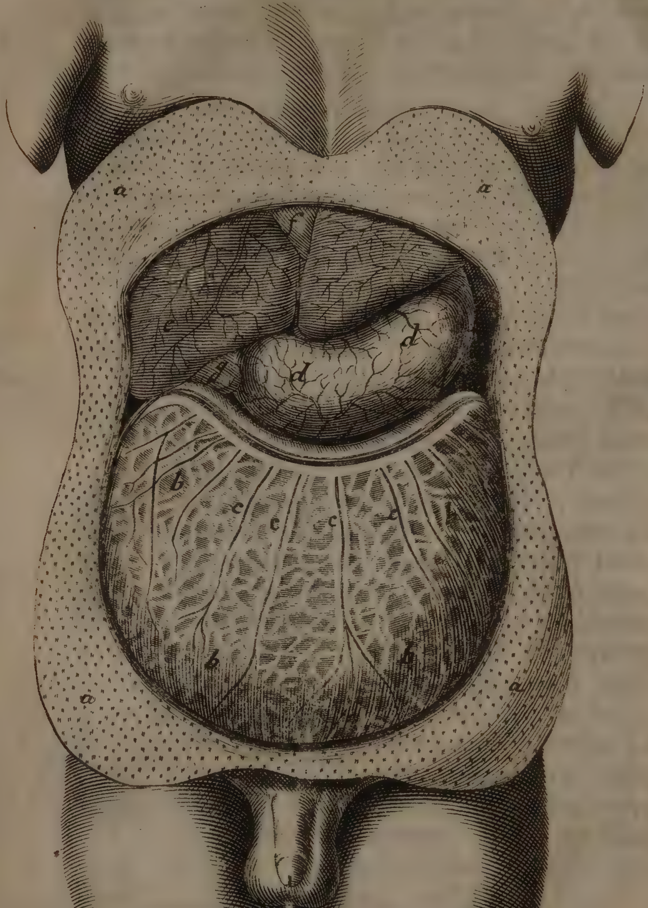
Duplicity.

It is *double* every where, but appears ſo to be chiefly about the *vertebræ* of the Loins, and in the *Hypogaſtrium*. For in the former place between its membranes lie the *Vena cava*, the *Aorta*, the Receptacle of the Chyle, and the Kidneys; and in the latter, the Bladder, and in Women the Womb.

Perforations. *Above*, where it adheres to the Midriff, it has three *foramina* or holes; the firſt on the right ſide, whereby the aſcending trunk of the *Vena cava* paſſes; the ſecond on the left ſide, for the Gullet (with the Nerves of the eighth pair inſerted into the upper Orifice of the Stomach) to deſcend by; the third behind, by which the great Artery or *Aorta*, and the intercoſtal Nerve deſcend, and the *ductus chyliferus* aſcends. *Below*, it has paſſages for the ſtreight Gut, for the neck of the Bladder, and in Women for the neck of the Womb; alſo for the Veins, Arteries and Nerves that paſs down to the Thighs. *Before*, in the *fœtus*, for the umbilical Veſſels, to paſs in and out by.

Proceſſes. It has two remarkable *Proceſſes* in Men placed before, by the *os pubis*, on each ſide one. They are certain oblong productions of its outer Membrane paſſing through the holes of the Tendons of the oblique and tranſverſe Muſcles, and depending into the Cod, there beſtowing one Tunicle on the Stones, and containing them like a bag. There are alſo two Proceſſes in Women, but they reach onely to the *Inguina* or Groins, and terminate in the upper part of the Privity, or the fat of *Mons Veneris*. The inner Membrane of the *peritonæum* (in Men) reaches but to the very holes, through which the Proceſſes deſcend, which it makes very ſtrait; but being either relaxed or broken, the outer gives way, and ſo there follows a Rupture, either the Caul, or the Guts, or both falling down thereby into the Cod. By the holes of the Proceſſes there deſcend in Men the Veſſels preparing the ſeed, and the Muſcles called *Cremaſteres*; and by them aſcend the Veſſels bringing back the ſeed. In Women there paſs by them the round ligaments of

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the Womb, which after ſpreading themſelves and growing jagged, are either joined to the *Clitoris*, or elſe terminate before they come at it, in the fat of *Mons Veneris.*

Veſſels. It has *Arteries* and *Veins* from the Mammary and Epigaſtrick, and from thoſe of the Midriff, or the Phrenick. It has ſlender threads of *Nerves* from the pairs of the *Vertebræ* of the Loins chiefly.

Uſe. Its *uſe* is to aſſiſt the equal and orderly contraction of the belly for the expulſion of the excrements, and by its ſmoothneſs to prevent the Guts being hurt by the circumjacent parts. Its ſeveral other more private uſes may be obſerved in the foregoing deſcription of it.

And thus far of the parts *Containing.*

Tab. I. ſhews the parts *contained* in the *Abdomen*, which appear to the firſt view after all the containing parts are removed.

aaaa *The Skin of the* Abdomen *turned back, whoſe inſide is fatty.*

bbbb *The* Omentum *or Caul.*

cccc *The Gaſtro-epiploick veſſels.*

dd *The Stomach.*

ee *The Liver turned ſomewhat up, that the Stomach may be the better ſeen.*

f *The broad ſuſpenſory ligament whereby the Liver is faſtened above to the Midriff.*

g *The Gall-bladder which is ſeated in the under or hollow ſide of the Liver, but here appears through the Liver's being lifted up.*

CHAP.

CHAP. V.

Of the Omentum.

Of the parts contained in the lower Belly.

THE parts *Contained* miniſter either to *Nutrition*, for the conſervation of the Individual; or to *Procreation*, for the conſervation of the *Species*.

Nutrition being an aſſimilating the Food taken, into the ſubſtance of the parts, before this is done, it undergoes two changes, firſt into *chyle*, and then into *bloud*.

All the Organs of *Chylification* are included within the *Abdomen*; but of *Sanguification* not ſo.

The principal Inſtrument of *Chylification* is the *Stomach*; but the *Caul*, *Guts*, (eſpecially the *ſmall*) *Pancreas*, &c. are aſſiſting to the Action.

The principal Inſtruments of *Sanguification* were heretofore ſuppoſed to be the *Liver* and *Spleen*, upon a preſumption that all the Chyle went to the one or other directly from the Guts: But ſince it has been diſcover'd that none of the *venæ lacteæ* paſs to them, but that the whole Chyle is conveyed into the common Receptacle, and from thence directly by the *ductus thoracicus* to the Heart, they are diſcharged from the task of ſanguification; though it cannot be denied, but they contribute to the refining and perfecting of the Bloud already made.

Both the Chyle and Bloud have their *Excrements*, the chief whereof are both ſeparated from them, and conducted out of the Body by parts contained in the *Abdomen.* Thoſe of the Chyle are the *fæces*, collected in the thicker Guts and evacuated by ſtool. Thoſe of the Bloud have been taught to be two, *viz.* choler and the ſerous humour. Choler is ſeparated by the Liver, and is received the thinner part of it by the *veſica fellea*; but the thicker by the *porus bilarius.* But it is not purely an excrement, ſeeing it has a conſiderable uſe within the body, as will appear in *chap.* 11. *of the Liver*, and deſerves not that name any more than the juice ſeparated by the *Pancreas.* The ſerous humour is ſeparated by the Kidneys, and from thence conveyed to the Bladder by the Ureters, to be piſt out.

The parts miniſtring to *Procreation*, are the *Genitals* both in Men and Women.

The Caul. *Its names.*

After the *Peritonæum* is ript open, the part which lies uppermoſt is the *Caul.* In Greek it is called ἐπίπλοον, from ἐπιπλέω, *innato*, becauſe it ſeemeth to ſwim upon the Guts. In Latin, *Omentum*, from *Omen*, becauſe the Soothſayers uſed to divine by it; and otherwiſe *Rete*, or *Reticulum*, from its contexture, which is *Net-like*; whence alſo in Engliſh it is commonly called the *Net.*

Subſtance.

It is *compoſed* of two *Membranes*, betwixt which the Veſſels run, and the Fat and Glands are placed. They are very thin, and, where the Fat hinders not, tranſparent.

Figure.

For *ſhape*, it is compared by Dr. *Gliſſon* to a Woman's Apron, when the lower part of it is turn'd up and tuck'd under the girdle. For it conſiſts of two Leaves, whoſe upper edges are knit to different parts; but its bottom is continued, and is like the bottom of a Satchel, to which it is alſo compared by ſome.

I ſay

Connexion. I ſay its two upper edges are knit to different parts: for that of the *fore* Leaf, beginning at the little Lobe of the Liver (which it involves) adheres to the under or hollow ſide of the Liver, to the *duodenum* and *pylorus* (ſomewhat towards their fore-ſide) to the bottom of the Stomach, and to the ſuture of the Spleen. That of the *hinder* or *inner* Leaf is continued from the former, and paſſing from the Spleen backwards, returns towards the right ſide again, by the way adhering to the *Pancreas*, to that part of the *Colon* that runs under the Stomach, to the Back, to the *duodenum* (ſomewhat towards its back-ſide) and at laſt is joined or continued to the fore Leaf at the aforeſaid little Lobe of the Liver. As for its bottom, it is knit to no part, but hangs looſe upon the Guts, reaching commonly a little below the Navel, but ſometimes to the very bottom of the Belly. Sometimes it falls down out of its place and deſcends into the Cod, which kind of Rupture is called *Epiplocele*; and other times when the Navel has been burſt, it has jetted out and filled the ſame, as in the *Omphalocele*.

Riſe. It is commonly ſaid to have a double *origine*, namely, its fore leaf to ſpring from the Stomach, and its hinder from the *Colon*. But ſeeing both theſe have their outer Coats from the *Peritonæum*, and that the Caul it ſelf cleaves alſo to it at the back, it is moſt reaſonable to draw its riſe from thence. Whence deſcending to below the Navel, it turns up again, and aſcending to the Stomach, cleaves to it; and ſo may more properly be ſaid to end, than to begin there.

Cavity. Betwixt its Leaves or Walls there is formed a notable cavity, which ſome very weakly have deſtin'd to divers uſes; whereas it reſults onely accidentally,

cidentally, and was not framed by Nature for its own ſake. " For (as Dr. *Gliſſon* reaſoneth) " whilſt Nature is ſollicitous about providing a " fit deputy (and that membranous) for the Me- " ſentery, and ſtuffing it with fat, through which " Veſſels may be carried to the Stomach, Liver, " Spleen, *Pancreas* and *Colon*, and whereby ſhe " may join all thoſe parts after a due manner; " and moreover whilſt ſhe takes care that it hang " down looſely, and beſmear both the Stomach " and Inteſtines with its unctuouſneſs; and in the " mean while be every where continuous to it " ſelf: I ſay, whilſt ſhe diligently propoſes all " theſe ends, if ſhe will obtain them, ſhe muſt " needs make the Caul hollow as it is above de- " ſcribed, and its propending part muſt needs imi- " tate the bottom of a pouch.]

Veſſels. The *Omentum* aboundeth with Veſſels of ſeveral ſorts, but ſuch as do not properly belong to it, or terminate in it, but are carried through it to other parts, from which they are moſt of them denominated. We ſhall begin with the *Arteries*, *1. Arteries.* and tranſlate hither the account that the above-named Doctour gives of them, and alſo of the Veins, which is very exact. " Its Arteries are " propagated from the *Cœliaca*; or rather its in- " ner Leaf, near its origine, receives and upholds " this Artery, (as ſoon as it ſprings out of the " *Aorta*) betwixt its Membranes. It is divided " into two branches, the *right* and *left*. The " *right* being joined to the *vena portæ* in the *Pan-* " *creas*, and fenced with the Membranes of the " *Omentum*, is carried into the hollow ſide of the " Liver: but it firſt ſends forth theſe branches; " the *pyloricus*, to the hinder ſide of the right ori- " fice of the Stomach; the *arteriæ cyſticæ gemellæ*,

“ the *epiplois dextra*, a portion whereof is diſpenſed
“ to the Gut *Colon* ; the *inteſtinalis*, carried
“ to the *duodenum* and beginning of the *jejunum* ;
“ the *gaſtro-epiplois dextra*, which is diſtributed
“ into the bottom of the right ſide of the Stomach----
“ The *left branch* of the *cœliaca*, called
“ *ſplenicus*, is greater than the *right*, and being
“ included within the Membranes of the hinder
“ Leaf of the *omentum* is carried directly leftways
“ under the bottom of the Stomach to the
“ ſuture of the Spleen. In its paſſage it ſends
“ forth many branches: *Upwards*, *one* notable
“ one called *arteria gaſtrica*, which ſpreads it ſelf
“ through the bottom and ſides of the Stomach,
“ and its upper orifice, where it gets the name
“ of *coronaria*; alſo a *ſecond* called *gaſtro-epiploïs ſiniſtra*,
“ whereof one portion is diſperſed into the
“ bottom of the left part of the Stomach, and
“ both its fore and hinder parts, and the remainder
“ is ſpent on the fore Leaf of the *omentum* ;
“ it ſends forth a *third* alſo, that famous branch
“ called *vas breve arterioſum*, which is inſerted
“ into the left ſide of the left or upper orifice of
“ the Stomach. *Downwards* alſo it ſhoots forth
“ ſome branches, as the *epiploë ſiniſtra*, which being
“ divided into two rivulets waters partly the
“ hinder Leaf of the *omentum*, and partly the
“ *colon* it ſelf; alſo another little branch which is
“ wholly ſpent on the left part of the hinder
“ Leaf of the Caul.

2. *Veins.* “ The *Veins* that anſwer to the ſaid Arteries
“ riſe almoſt all from the *ſplenick* branch ; the
“ trunk of which Veins, after it is joined with
“ the ſtem of the ſplenick Artery, puts forth
“ branches exactly anſwering and proportioned
“ to thoſe of the ſaid Artery ; and all the bran-

" ches of both Veſſels are diſpenſed to the ſame " reſpective parts, and are denominated from " them, ſo that 'twould be needleſs to ſtay longer " on their diſtribution: onely the branch that " goes to the right or lower orifice of the Ven- " tricle, called of ſome *pyloricus*, takes its riſe " from the trunk of the *porta* before 'tis di- " vided.

It has but very ſmall Nerves proceeding from the intercoſtal or ninth pair: which, as the Veins, accompanying the Arteries and having the ſame names, we ſhall not take the pains to trace. 3. *Nerves.*

But beſides theſe Veſſels formerly known, *Malpighius* thinks that he has diſcovered a new ſort, which he calls *ductus adipoſi*, and will have to nouriſh and encreaſe the Fat, diſcharging the Arteries and Veins from that office. He ſays, " they are ſo very ſmall that they admit not a " ligature, from whence one might diſcover their " nature, *viz.* whether they be hollow, ſo as " that the Fat might be propagated by them as by " pipes; or whether they be only like filaments " or ſmall threads, along which the fatty parti- " cles drill. But he inclines to think, they are " hollow like Veins. He confeſſes, that he could " not yet diſcover by the Eye from whence they " take their riſe, though he has endeavoured to " find it out in many, and thoſe divers, ſorts of " Animals: but thinks it probable, that they ei- " ther ſpring from the Spleen, or from the Sto- " mach, or from the Glands. The reaſons why he ſuſpects they may ſpring from the *Spleen* are, " That there is a notable Vein ariſing from the " Spleen, that ſends abundance of ſlips all through " the Caul, and the Spleen in all Creatures is " placed in the Center of the Caul: And that 4. Vaſa Adipoſa.

" there are abundance of fibrous Bodies diſcern-
" able in the Spleen, that run through its Paren-
" chyma from one Membrane to another, and
" have no communication with the Blood-veſſels.
" Theſe, he ſays, ſo far as he could perceive, are
" cloſely knit to the Membrane of the Caul that
" enters the Line or Suture of the Spleen with
" the Splenick veſſel; and ſeeing it appears not
" as yet, whether they be hollow, or of what
" Origine they are, or what uſe they ſerve for,
" one may reaſonably doubt whether they be not
" the firſt root of theſe *ductus adipoſi*, or at leaſt
" have communication with them. As for their
" riſe from the *Stomach*, this may be ſaid, That
" the Caul has a notable connexion with it, be-
" ing knit ſtrongly to it through its whole
" length, and receiving Blood-veſſels from it.
" That in ſome Fiſh there grows a notable Mem-
" brane from the bottom of the Stomach, that
" has Veſſels differing from the ſanguineous.
" And he thinks it not unreaſonable to ſuppoſe,
" ſeeing in the Stomach, and in the Inteſtines
" that are continued to it, by means of the at-
" trition and exquiſite ſolution of the Food, the
" particles of it acquire ſuch a liberty, that thoſe
" that were originally in it being let looſe, or
" by a new mixture and mutual adaptation being
" ſhaped and conglobated into a new nature,
" have new motions and actions; I ſay, ſeeing
" by theſe means there may not want matter for
" propagating of Fat, it will not be improbable
" that there are proper Veſſels alſo for the pro-
" pagating of it, and conveying it to the parts.
" The third part whence theſe Ducts may ariſe,
" are the *Glands*, into which, later Anatomiſts
" have obſerved lacteal Veſſels to be carried.

"The Glands themſelves (he ſays) contain "much Fat, from whence it is that they are ſo "luſcious to the taſte; and he thinks it pro"bable, that the Glands are either the Fountains "of Fat, or at leaſt are a *medium* of its propa"gation.] Thus that curious Perſon. But whether there be indeed ſuch peculiar Veſſels, I cannot affirm, having never been able to diſcover them by the naked Eye, or by ſuch Glaſſes as I have made uſe of.

5. Venæ lacteæ.

Dr. *Wharton* in his *Adenographia*, *cap.* 12. declares, That he has obſerved ſome *venæ lacteæ* ariſing out of the bottom of the Stomach, (*Diemerbroeck* ſays, from the beginning of the *jejunum*) which are received into the *omentum*, and being inſerted into a pretty large Gland do from thence ſpring again, and are carried obliquely downwards, croſſing the right end of the *pancreas*: One would think, ſaith he, at the firſt ſight, that they enter'd into the *pancreas*: but they do in truth paſs by it, and make towards the common receptacle of the Chyle, into which they empty themſelves.

Its Glands.

The ſame learned Phyſician does in the ſame place give an account of two *Glands* that are naturally found in it. One *greater* near its being joyned unto the *pylorus*, and into this it is that the *lacteæ* are inſerted; another ſomewhat *leſs* placed towards the Spleen; and this he has obſerved ſometimes double, triple, yea manifold. Preternaturally it has ſometimes many more.

Fat.

The laſt part of which the Caul conſiſts, is its *Fat*, which is not ſpread equally all over it, but is gathered there chiefly where the Veſſels run; the ſpaces betwixt being only membranous. It is collected in little membranous Cells, included betwixt the two inveſting Membranes, and its matter is derived from the Blood-veſſels according to the common opinion, but according to *Malpighius*, it is communicated by the *ductus adipoſi* before deſcribed. The fore leaf has more fat than the hinder; and the upper part of the fore leaf that is knit to the Stomach, is the fatteſt of it. In very fat perſons this part grows to a great bulk; but in conſumptive people there is little left beſides the Membranes and Veſſels; and * *Peyerus* writes that in all hydropick perſons that he ever diſſected, (and he has diſſected very many) the Caul was always extenuated and putrid.

** Meth. Hiſt. Anat. Med. p. 97.*

Its uſes.

The *Uſes* of it are theſe: *Firſt*, it cheriſheth the internal heat of the lower part of the Stomach, and of the Inteſtines. Which appears by the Story that *Galen* tells of a Fencer, who being wounded in the Belly, and the Caul being taken out, afterwards when the Wound was healed up, felt great coldneſs upon his Belly, ſo that he was forced to wear Woollen upon it. Yet *Riolanus* affirms from his own obſervation, that ſuch as have had the Caul cut out, have found no prejudice by it to their concoction.

Secondly, It miniſtreth nouriſhment to the parts in a long want of food, its fat being received into the Veins, and mixed with the maſs of blood.

Thirdly, Like the Meſentery, it ſerves to convey ſafely the Veſſels to other parts, as to the Stomach, *Colon*, *Duodenum*, Spleen, *&c.*

Fourthly, It keeps the outer Superficies of the Guts moiſt and glib, that they may the better perform their Periſtaltick motion.

Fifthly, It ſerves alſo to knit looſly together the Stomach, Liver, Spleen, *Pancreas*, *Colon*, and

Duodenum. This connexion was to be looſe, becauſe the Stomach and Guts are ſometimes diſtended, and ſometimes empty, and accordingly take up more or leſs room; but yet it is not ſo looſe, but that it is ſome ſtay to them, and partly hinders them from departing out of their places.

CHAP. VI.

Of the Gullet.

The Gullet.

THE Caul being removed, the *Stomach* offers it ſelf next to examination: but ſeeing the *Gullet* is as it were the Pipe or Funnel to it, though that be ſeated in the *Thorax*, and ſo ſhould be conſidered in the next Book; yet becauſe of its relation to the Stomach, being but an appendage of it, we ſhall treat of it here, before we proceed to that.

Its Names

It is called in *Greek*, στόμαχος, *quaſi* στενὸς ϗ μακρὸς, becauſe it is *narrow* and *long*: As alſo οἰσόφαγος, ὅτι οἴσει τὸ φάγημα, becauſe it *conveys the meat* to the Stomach.

Origine and deſcent.

It is an organical part, round and hollow, beginning at the root of the Tongue, behind the *larynx*, (which part of it is called *pharynx*) and deſcendeth from thence directly between the Windpipe and the *vertebræ* of the Neck, and the four firſt *vertebræ* of the *Thorax*, upon which it reſteth; but when it is come to the fifth *vertebra*, it giveth way to the deſcending trunk of the great Artery by bending a little to the right ſide; afterward accompanying the Artery down to the ninth *vertebra*, there it turns a little to the left again, and climbs upon the Artery; and by and by about the eleventh *vertebra* it paſſeth through the Midriff, a little on the left ſide of its nervous Centre, at a hole diſtinct from that of the great Artery, and is inſerted or continued unto the left Orifice of the *Ventricle*.

Subſtance.

It is *framed* of three *Membranes*: The *outmoſt* is common to it and the Stomach, and is very thin, being endowed only with membranous Fibres, and thoſe very ſlender. Some derive its Origine from the Midriff, others from the *Pleura*, others from the *Peritonæum*, and others laſtly, from the Ligaments of the *vertebræ* of the Neck and Breaſt upon which it reſteth. "All which "Opinions (according to Dr. *Gliſſon*) may be "true, if they be intended only of an Origine "of continuation or connexion, ſeeing it is conti-"nued plainly to the three firſt, and knit to the "laſt: but none of them is true, if they be in-"tended of a ſuſtaining, or maintaining Origine, "or of a principle of influence. The ſecond or *middle* is fleſhy and thick, and conſiſts of two ranks of fleſhy Fibres, which aſcend and deſcend obliquely, (ſpiral-wiſe) and do mutually intercuſſate or croſs one another, ſo as that the Fibre which before it meet with another to interſect, did lie underneath another, rides upon that which it interſects, and ſo continues uppermoſt till it come to a ſecond, under which it paſſes again, and ſo on by turns. The third or *innermoſt* is indued with ſlender ſtreight Fibres, and thoſe only, as ancient Anatomiſts have taught; but Dr. *Willis* affirms it to have Fibres of divers kinds, and thoſe diverſly woven one with another. It is wholly nervous, ſaving a certain woolly or downy ſubſtance that cloaths its inſide. It is continued to that Membrane that covereth the Mouth, Jaws and Lips; and (according to Dr. *Willis*) it deſcends three Fingers breadth below the Mouth of the Stomach. From its being thus common to the Mouth, Gullet and upper orifice of the Stomach, proceeds that great conſent among theſe parts in Vomiting, *&c.*

Veſſels. It hath *Veins* in the Neck from the Jugulars, in the *Thorax* from the *vena ſine pari*; but where it is joyned to the Ventricle, it hath ſome twigs from the *ramus coronarius*, which is a branch of the *vena portæ.*

It hath *Arteries* in the Neck from the *Carotides*; in the *Thorax* from the Intercoſtals, and in the *Abdomen* from the *ramus cœliacus coronarius.*

Nerves it hath from the *par vagum* or eighth pair.

Glandules. It hath four *Glandules*; two in the Throat, which are called *Tonſillæ*, or Almonds, common to it and the *Larynx*, which ſeparate a mucous or pituitous humour to moiſten them. (Their deſcription ſee in *Book* II. *chap.* 14.) Other two it hath near its middle, on its out- and back-ſide, about the fifth *vertebra* of the *Thorax*; namely, where it gives way to the trunk of the *Aorta*, and turns ſomewhat to the right-ſide, or at that place where the *aſpera arteria* is divided into two branches. Theſe are as big, each of them, as a Kidney-bean, and of the ſame ſhape: but ſometimes there are more than two, and then they are leſs. They are ſoft and fungous: and their uſe has been reckoned to be for the ſeparation of a juice to moiſten the Gullet. But Dr. *Wharton* rejects this opinion, becauſe there appears no excretory Veſſel that might convey the liquor that is ſeparated in them, to within the Gullet. However though ſuch Veſſel do not appear, yet it is more probable that they ſerve for that uſe, than for that which he aſſigns to them, *viz.* to draw out from the *lympha* that runs through them, that juice which is more mild and fit for nouriſhment, for the uſe of the Nerves that are faſtned to them; or to depoſite the remainder into the common chyliferous duct by a Pipe which he ſuppoſeth there muſt be, but does not deſcribe.

Uſe. The Gullet ſerveth as a Conduit to convey Meat and Drink by from the Mouth to the Stomach: for theſe being turned down into the Throat by the Tongue, all the Membranes of the *pharynx* are relaxed for the reception thereof, and preſently the ſame are ſqueezed down the Gullet by the conſtriction of its middle coat, and the Muſcles of the *pharynx*. But concerning its action, and in what manner, and by what help ſwallowing is performed, ſee more fully and particularly in the fifth Book, *Of the Muſcles*, chap. 12.

CHAP. VII.

Of the Ventriculus *or Stomach.*

The Stomach. Its Names.

THat part which we term *the Stomach* in Engliſh, in Latin is called *Ventriculus*, without any addition, to diſtinguiſh it from the other Ventricles, which have always ſome other word added to determine the ſignification, as *Ventriculus cordis*, *ventriculus cerebri*. In Greek it is called γαστὴρ, and κοιλία, (from its *cavity*) as alſo καρδία, which laſt name is given chiefly to its upper Orifice, which has a notable conſent with the Heart from their community of Nerves, (both being ſupplied by the *par vagum:*) and hence a pain here, is called *Cardiaca paſſio.*

Number.

In Man it is but *one*; but ſuch Quadrupeds as chew the Cud, eſpecially all that are horned, have *four* Stomachs; the firſt whereof is called μεγάλη κοιλία, in Engliſh the *Paunch*; the ſecond κεκρύφαλος, in Latin *reticulus*; the third ἐχῖνος, *omaſus*, in Engliſh the *Feck*; the fourth ἤνυστρον, *abomaſus*, in Engliſh the *Read.* Such Fowl alſo as live upon Corn have two Stomachs; the firſt membranous, called *ingluvies*, the *Crop*; the ſecond carnous, called *ventriculus carnoſus*, in Engliſh the *Gizard.* Betwixt theſe two ſome name a third, called *echinus*, but it ſeems rather a paſſage only betwixt theſe two, than it ſelf a diſtinct one. But this is not a place to be particular as to the differences of number or ſhape, *&c.* of the Stomachs of ſeveral Animals, having deſigned only a ſuccinct Anatomy of Man. But the inquiſitive may ſatisfie themſelves in the learned Dr. *Charleton*'s ſecond Prelection before the College of Phyſicians, entituled *Hiſtoria Ventriculi*; or more fully in the ingenious Dr. *Grew*'s *comparative Anatomy of Stomachs and Guts*, publiſhed with his *Muſeum Regalis Societatis.*

Situation.

It is *ſeated* immediately under the Midriff, which when it is too full it bears againſt, and ſo cauſeth a difficulty of breathing, by hindring the motion of it. In the forepart on the right ſide, it is covered with the hollow ſide of the Liver; on the left ſide it is touched by the Spleen; its backſide upon full feeding bears againſt the *vena* *cava* and ſpine; to its bottom length-ways is the Caul knit; the backſide of its bottom reſteth on the *Pancreas*, and the foreſide on the *Colon*; all which further its heat.

Bigneſs. The *bigneſs* of it is commonly ſuch, as is capable to receive ſo much food at one time, as is ſufficient for nutrition. When it is emptied, Dr. *Gliſſon* ſays, that it hardly weighs an hundredth part of the whole Body; ſo that 'tis a wonder ſo ſmall a part ſhould cook for the whole. It is leſs in humane bodies than in Brutes, conſidering the proportion of their bodies. It is commonly leſs in Women than in Men. They who have wide Mouths, have large Stomachs.

Figure. It is longiſh and pretty round, very much reſembling a Bagpipe in ſhape. It hangs croſs the Body; and its two Orifices, by which the Meat is received in from the Gullet, and let out into the Guts, ſtand higher up than its middle, ſo that its upper part makes as it were the concave of an half-moon. It is more capacious on the left ſide than on the right.

Connexion. Its left or upper Orifice is continued from the Gullet, by the means whereof it is knit to the Midriff; and its right or lower Orifice is continued to the Gut *Duodenum*. Its bottom in the whole length of it has the upper edge of the fore-leaf of the Caul adhering to it, by whoſe mediation it is joyned to the Liver, Back, Spleen, *Colon* and *Pancreas*.

Subſtance. The *ſubſtance* of it is membranous, that it might admit of diſtention and contraction. It conſiſts of three *Membranes*. The *firſt* or outmoſt is *common* to it and the Gullet, and is derived from the *Peritonæum*. But yet it is not wholly derived from thence: For as Dr. *Gliſſon* argues, Seeing this coat is fibrous, and the *Peritonæum* is not; its Fibres cannot be owing to that, ſeeing *Nihil dat quod non habet.* Theſe Fibres (being nervous) are ſtreight, running from one Orifice to the other, and encompaſſing both its bottom and ſides in their whole longitude. Near the Orifices and towards the bottom of the Stomach, they are far thicker than in the ſides, inſomuch as there they ſeem in a manner carnous and motory. They croſs at right angles the carnous ones lying next under them, as ſerving not only to cover them, but to bind them faſt, and to hinder them from ſtarting out of their ranks.

The *ſecond* or middle coat is *proper*, and fleſhy, and conſiſts of two ranks of fleſhy Fibres, (with a *Parenchyma.*) The outer rank are the more numerous, and are *tranſverſe*, running croſs or round the Stomach; and under theſe lie another rank, which (as Dr. *Willis* affirms) upon the top of the Stomach run ſtreight from the left Orifice to the right; but the remainder of them tend along each ſide of the Stomach obliquely forwards toward the bottom, and meet one another there.

The *third* or inmoſt is likewiſe *proper*, but is nervous. On its inner Superficies it is lined with a downy ſubſtance, (as the inmoſt of the Gullet alſo is) ſomething like Velvet, which appears very plainly after a light boiling of the Stomach. Dr. *Willis* thinks this downy cruſt to be a diſtinct coat from the Nervous, becauſe after dipping the Stomach in hot water, it may be eaſily ſeparated from it: And when it is ſo ſeparated, becauſe on its outer Superficies, which adheres to the Nervous coat, it is beſet with abundance of ring-like Glands, he calls it the *glandulous* coat. When this is removed, the truly Nervous coat appears, which is endued with all ſorts of Fibres, but the ſtreight are moſt numerous. There run abundance of Blood-veſſels along it, which terminate in its inner Superficies that adheres to the glandulous coat. So that 'tis probable, the mouths of the Arteries may diſgorge ſomewhat into the Stomach through the glands in which they terminate.

Beſides theſe Membranes with their Fibres, the Stomach hath alſo a *parenchyma*, eſpecially its middle coat: but it is not ſanguineous, but of a peculiar ſort. That it has a *parenchyma* is plain; for without one how ſhould the inequalities, that ſpring from the texture of the Fibres, be filled up? Or whence ſhould all that ſlimy ſtuff come, that thoſe who make ſtrings for muſical Inſtruments, ſcrape off from the ſmall Guts? Doubtleſs that can be nothing but this *parenchyma* we ſpeak of, ſeeing after ſuch ſcraping they have loſt nothing of their ſtrength, which they owe to the Fibres and Membranes. And 'tis apparent that the ſubſtance of the Guts and Stomach is the ſame. Some think this *parenchyma* to be almoſt wholly glandulous.

Orifices. It hath two *Orifices*: Of which the *firſt* is on the left ſide, and is called the *upper*; not becauſe it is ſituated higher than the other; but becauſe the Meat enters into the Stomach by it, as it goes out by the other, which is therefore called the *lower*. This is wider than the other, becauſe the Meat is only groſly broken by chewing when it paſſeth through it; whereas it is diſſolved into a liquor (called Chyle) when it paſſes out by the other. It is called in Greek καρδία, *cor*, from whence the region of the Stomach under the *cartilago enſiformis*, is called *ſcrobiculus cordis*, or Heart-pit; and hence alſo the pains which happen in it, are called καρδιαλγίαι, and καρδιωγμοὶ, becauſe there is a great conſent between it and the Heart, by reaſon that they both of them derive their Nerves from the eighth pair; ſo that one being affected primarily, the other muſt ſuffer by conſent. It hath orbicular Fibres, that the Meat and Drink being once received within the capacity of the Stomach, it might be exactly ſhut, leſt fumes and the heat ſhould break out to the hindrance of Concoction, and annoyance of the Head.

The *other* is ſeated on the right ſide, and by the Greeks is called πύλωρος, *janitor*, or door-keeper, becauſe as a *Porter*, it makes way for the *Chyle* to deſcend to the *Duodenum*. Here the inmoſt nervous Coat is very full of wrinkles; and the middle, which is carnous, as every where elſe, ſo here alſo hath two ranks of Fibres; firſt tranſverſe or anular, to ſtraiten this paſſage or ſhut it upon occaſion; and ſecondly ſtreight, *viz.* ſuch as running length-ways do gather up and draw the reſt of the Stomach towards this door, for the diſtribution of the Chyle after it has been ſufficiently concocted in the Stomach. And on the contrary, when theſe Fibres begin to be contracted at the other end, they often draw the *pylorus* towards the left Orifice, as in Vomiting: And when the Convulſion is continued further, the *Duodenum* is drawn upwards, and thence the Choler and Pancreatick juice are pumpt up as it were into the Stomach. The beginning of the *Pylorus*, where its Coats are thickeſt, Dr. *Willis* calls its *antrum*.

Veins. It hath *Veins*, firſt immediately from the *trunk* it ſelf of *vena portæ*, and this is *pyloricus ramus*; ſecondly, from the *branches* of the ſame, and ſo from the *ramus ſplenicus* thereof it hath *gaſtrica minor*, and *gaſtrica major* (the largeſt Vein of the Stomach) from whence *coronaria* ſpringeth; *gaſtro-epiplois ſiniſtra*, and *vas breve*: and from the *ramus meſentericus*, before it be divided, it hath *gaſtro-epiplois dextra.* All theſe Veins, (as the reſt of the whole Body) ſerve only to convey back again (towards the Heart) the remains of the arterial Blood which in the circulation is not ſpent on the refection and nouriſhment of the part; though ſome learned modern Anatomiſts think, that beſides the arterial Blood, they receive ſome of the more ſubtile part of the Chyle for its readier conveyance into the maſs of Blood, and thence draw a reaſon of the very quick refreſhment that hungry and faint perſons receive by eating or drinking.

Arteries. It hath its *Arteries* from *ramus cœliacus*, which do accompany every Vein, and have the ſame denomination with them. Moſt Anatomiſts are now of opinion, that theſe Arteries do not only convey blood to the Stomach for its nouriſhment, and for its warmth to help its Concoction; but that they empty out of themſelves through the Glands of the Stomach, a certain ſpirituous liquor into its Cavity, which being joyned with the reliques of the Chyle that ſtick in its downy Coat, make that juice which is called the *ferment* of the Stomach, which contributes more to the diſſolving the Aliments than the *heat* of it, which the Ancients made the main Inſtrument of its action.

It

Nerves.

It hath *Nerves* from the *par vagum*, (Dr.*Willis*'s eighth pair) whoſe trunks paſſing down (below the pneumonick branches) by the ſides of the Gullet, are each divided into *two branches*, the *outer* and *inner*. Both the *inner branches* by and by bending to one another grow into one, which paſſing with the Gullet through the Midriff goes on the *outſide* of the Orifice of the Stomach, and ſpreads it ſelf in its *bottom*. *The two outer branches* in like manner inclining to each other unite into one, which deſcending to the Stomach by the *œſophagus*, and arriving at the *inner ſide* of its Orifice, there turns back and creeps through its *upper part*. The *inner* and *outer branches* as they come one on one ſide, and another on the other ſide of the upper Orifice of the Stomach, ſend forth many ſmall twigs, which mutually inoſculating make there a net-like *plexus*. From this *multitude* of Nerves interwoven in the Mouth of the Stomach, proceeds that great conſent betwixt it and the Head. (So that in any great concuſſion of the Head there follows a Vomiting, and from the foulneſs of the Stomach the Head-ach, *&c.)* Here at this upper Orifice, from the ſame reaſon, is the ſenſe of Hunger moſt urgent. Into the bottom of the Stomach are ſome twigs inſerted that ſpring from the left *Meſenterical branch* of the Intercoſtal Pair.

Venæ lacteæ.

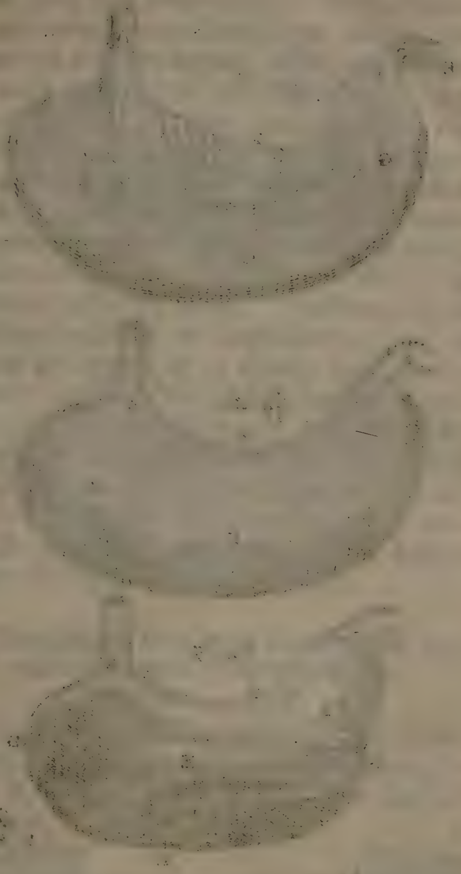
There are alſo ſome *Venæ lacteæ* which ſpring out of the bottom of the Stomach, whoſe paſſage from thence to the Common Receptacle we deſcribed before in Chap. 5. from Doctor *Wharton.*

The cauſe of Hunger.

Now as to the cauſe of *Hunger*, omitting ſundry opinions about it, I ſhall give but that one reaſon of it, which *Diemerbroeck* thinks the moſt probable, and thus expreſſes: “ It is cauſed from fer- “ mentaceous (or diſſolving) particles partaking “ of acrimony, bred of ſpittle ſwallow’d and “ other ſaltiſh or acid things eat or drunk, which “ ſticking to the coats of the Stomach, and “ brought to ſome acidity by it, or remaining “ in it after the Chyle is ſent off, affix’d to its “ inmoſt wrinkled Membrane (eſpecially about “ its upper orifice) moleſt it by their twitching, “ which twitching being communicated to the “ Brain by the Nerves of the eighth pair, an ima- “ gination of taking meat is excited to aſſwage “ that troubleſome corroſion.] He that doubts of the truth of this opinion, may find it evinc’d at large in his *Anatome corporis humani*, cap. 6. pag. 39, *&c.*

The action of the Stomach. Chyle.

The *action* of the Stomach is *Chylification.* Now *Chyle* is a pretty thick white juice like Barley-cream, made out of the aliments taken; the manner whereof is well expreſt by the ſame Author. “ While the meat is chewing in the Mouth, it “ is mix’d with the *ſaliva*, which not onely ſof- “ tens it, but endows it with a certain fermenta- “ tive quality, unto which contributes alſo the “ drink, (whether Beer, or Wine or ſome other) “ which often contains in it acrimonious parti- “ cles and fermentaceous Spirits. The Stomach by “ the help of its Fibres embraceth cloſely the “ Meat thus chew’d and ſwallow’d, and mixeth “ therewith Specifick fermentaceous juices, “ bred in its inner Coat, and impregnated with “ the *ſaliva.* Then by a convenient heat there “ is made a mixture and eliquation of all; for “ that the fermentaceous particles entring into “ the Pores of the Meat, do paſs through, agi- “ tate and eliquate its particles, diſſolving the



pag. 43. TAB. II.

fig. 1.

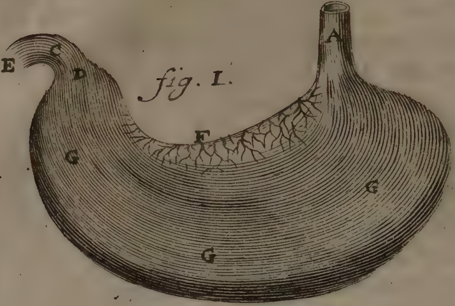


fig. 2.

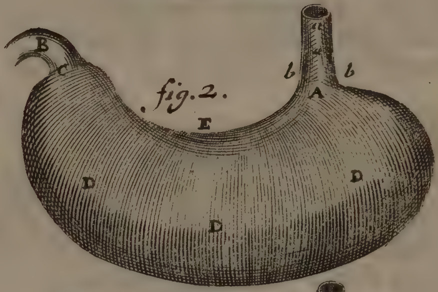


fig. 3.

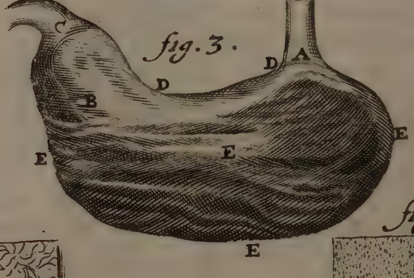


fig. 4.

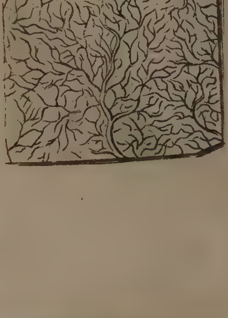
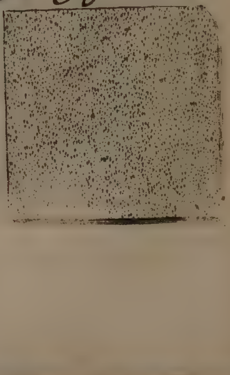


fig. 5.



" purer from the craſs, and making them more
" fluid, ſo that they make another form of mix-
" ture, and unite among themſelves into the re-
" ſemblance of a milky cream; after which, to-
" gether with the thicker maſs, with which they
" are as yet involv'd, by the conſtriction of the
" Stomach they paſs down to the Guts, where
" by the mixture of the Bile and the pancreatick
" juice, they are by another manner of fermen-
" tation quite ſeparated from the thicker maſs,
" and ſo are received by the lacteal Veſſels,] as
the thicker is ejected by ſtool. This ſeems to me a very rational account of Chylification, and of the *ferment* by which it is chiefly performed; unleſs there ought to be added another Ingredient to compoſe the ferment, *viz.* the Air, whoſe particles are plentifully and intimately mixed with the Meat in chewing, and ſwallowed with it. See farther of the action of the Stomach in Dr. *Charleton*'s third Prelection before the College of Phyſicians, *Sect.* 6. *p.*112.

Tab. II. *Repreſenteth the ſeveral Coats of the Stomach with their Fibres, from Dr.* Willis.

Fig. 1. Expreſſes the outmoſt nervous Coat of the Stomach, whoſe nervous Fibres running lengthways of it, cut the outer carnous ones that lie under them, at almoſt right angles.

A *The Gullet, in whoſe outer Coat all the nervous Fibres deſcend ſtreight, croſſing obliquely the carnous ones that lie under them.*
B *The mouth of the Stomach.*
C *The* Pylorus *with its* antrum D. *and a portion of the* Duodenum *continued from it* E.

E *The upper part of the Stomach, where the Blood-veſſels appear very numerous.*

GGG *The nervous and ſlender Fibres running length-ways of the Stomach from one Orifice to another, and further each way.*

Fig. 2. Shews the Stomach deveſted of its utmoſt nervous Coat, that the outer or convex Superficies of the middle Coat with its carnous Fibres may appear.

A *The mouth of the Stomach into which the Gullet* aaa *is inſerted, and which the circular carnous Fibres* bbb *encompaſs, ſhutting it upon occaſion by contracting themſelves.*

B *The* Pylorus *with the* Duodenum *continued to it.*

C *The Orifice and* antrum *of the* Pylorus, *both which, the circular Fibres, when they are contracted, ſtraiten, and ſeem to ſhut.*

DDD *The circular Fibres encompaſſing the Stomach depthways.*

EEE *The top of the Stomach, where theſe Fibres ſpringing, whilſt they are contracted draw towards it the whole bulk of the Stomach very much ſtraitned.*

Fig. 3. Shews the Stomach turn'd inſide outward, that the downy Cruſt with the wrinkles and folds may be ſeen.

A *The left Orifice of the Stomach.*

B *The* antrum *of the* Pylorus, *in which the Coats are thicker.*

C *The right Orifice to which the* Duodenum *is continued.*

DD *The top of the Stomach betwixt the two Orifices.*

EEEE *Its ſides, end and bottom, in which the downy cruſt of the inmoſt Coat, with the wrinkles and furrows therein, are expreſt to the life.*

Fig. 4. Repreſents a piece of the nervous Coat, in which, the downy Cruſt being removed, its inner or concave Superficies appears, with a very thick branching of Veſſels.

Fig. 5. Shews a piece of the downy or glandulous coat, in which its outer Superficies, that cleaves to the nervous Coat, appears very full of Glandules and the mouths of Veſſels.

CHAP. VIII.

Of the Inteſtines, or Guts.

The Guts: Their Name. THE *Guts* are called in Latin *Inteſtina*, in Greek (Ἔντερα, ἀπὸ τοῦ ἐντὸς εἶναι), from their being placed *within* the Body.

Figure. They are oblong, membranous, hollow, round, diverſly twiſted, continued from the *pylorus* to the *podex*, for conveying the Chyle, and the excrements of the firſt concoction.

Connexion. They are *knit* together by the Meſentery, by which and by the intervention of the Caul, (part of which adhereth to the beginning of the *Duodenum*, and the middle part of the *Colon*) they are tied to the Back, and fill the greater part of the Cavity of the *Abdomen*.

Subſtance. They are of a membranous *ſubſtance* like the Stomach; thinner in the ſmall Guts, and thicker in the great; and the nearer they come to an end, the thicker they are, as the lower end of the *Colon*, and the *Rectum*.

Length. The *length* of the Guts is about ſix times the Party's length whoſe they are. They are thus long (and winding) that the concocted Aliments paſſing out of the Stomach, by their long ſtay in the Guts, might the more commodiouſly be fermented by the admixture of the bile and pancreatick juice, and ſo the more ſubtile chylous parts being ſeparated from the thicker maſs, might be the better and more leiſurely driven into the narrow Orifices of the lacteal Veſſels, partly by the proper periſtaltick motion of the Guts, and alſo by the impulſion of the Muſcles of the *Abdomen* moved in reſpiration. And hereby two great inconveniences are avoided; the one of eating almoſt continually, which would have follow'd from the Chyle's not having time enough to have its particles ſeparated and diſtributed, before it would have arrived at the *anus*, whereby the Body muſt needs receive but ſmall ſuſtenance from any thing eat or drunk; the other (for the ſame reaſon alſo) of having almoſt a continual need of going to ſtool; as happens to ſuch voracious Animals as have a ſtreighter paſſage from the Stomach to the *anus*.

Coats. They have three *Coats* like the Stomach. The *outmoſt* is *common*, and is derived from the *Peritonæum*, but mediately; for in the *Duodenum*, and that part of the *Colon* which runneth under the Stomach, it proceedeth immediately from the membranes of the Caul, which is knit to thoſe Guts; and in the *Jejunum*, *Ileum*, the reſt of the *Colon*, the *Cæcum* and *Rectum*, it proceedeth from the Membranes of the Meſentery. It is all over beſmear'd with Fat, and is truly nervous.

The other two Coats are *proper.* The *outer* of them, being the middle of the three, is carnous. It has two ranks of moving Fibres, one lying under the other; The firſt and inner rank is anular or tranſverſe, which encompaſſing the whole cavity of all the Inteſtines in very cloſe order, is inſerted into the hem or ſelvedge of the Meſentery as into its Tendon. The other rank is of ſtreight Fibres, which being ſpread above the former, and cutting them at right angles, reach along the whole length of the Inteſtines; and their Tendon ſeems to be the outmoſt coat, which being wholly nervous, or as it were tendinous, is wrapt about the whole rank of theſe Fibres.

The *innermoſt* is nervous, although it ſeem to be fleſhy, by reaſon of the cruſty ſubſtance with which it is lined. This lining is called by *Pecquet* a ſpongy *periſtoma*, by *Bilſius* a woolly *moſs*; it ſerves as a Filtre for the Chyle to tranſcolate through in order to its entrance into the *venæ lacteæ*; and beſides, it hindreth excoriation, which might be cauſed when ſharp humours paſs through the Guts. Some (as particularly Dr. *Willis*) take it for a diſtinct coat, and call it *glanduloſa tunica* or *villoſa*; being altogether like that of the Stomach, which is deſcribed in the foregoing Chapter, and having the ſame uſe with it.

This Membrane in the ſmall Guts, eſpecially the *Ileum*, is full of wrinkles, to ſtay the *Chyle* from paſſing too ſoon; which wrinkles are cauſed, for that this inmoſt coat if it be ſever'd from the former and the wrinkles ſtretcht open, will be (according to *Fallopius*'s obſervation) thrice as long as it. And the ſame Membrane is expanded in the *Colon* into little cells, for the ſlower paſſing of the *fæces*. Theſe wrinkles in both are called by * *Kerkringius*, *valvulæ conniventes*. It has all ſorts of Fibres, and contains the mouths of all the Veſſels both ſanguineous and lacteal, which are cover'd with that ſpongy cruſt beforementioned.

* Kerkr. *obſ. Anat.* xxxix. p. 85.

What was ſaid of the *Parenchyma* of the Stomach in the foregoing Chapter, may without repeating it here, be applied to the Guts likewiſe.

Glands.

Many late Anatomiſts have obſerved abundance of *Glands* to ſtick in this inmoſt coat, (beſides thoſe which make Dr. *Willis*'s glandulous coat) but they have been treated of, by none, I think, ſo exactly as by *Peyerus*, who has writ a ſmall tract of them, and deſcribes them thus. " They are very ſoft and delicate as to their ſub" ſtance, *he ſays*, ſo that if one handle them rug" gedly, they are eaſily ſqueezed and defaced. " They cannot be ſeen on the outſide; but if one " ſlit open the Gut lengthways, and thruſting his " finger againſt the outſide, preſs the inſide out " by the ſlit, and hold it to the light, they plain" ly appear like little teats, with each one a " ſmall pore in its top towards the cavity of the " Gut, as their baſes or backſides have bloud" veſſels, (and, as he ſays, Nerves too) inſerted in" to them. If one preſs with his finger on their " backſide, there will iſſue out of their pore a clam" miſh humour. There are but very few (ſome" times none) of them in the *Duodenum* or *Jeju" num*, but they are moſt numerous in the *Ileum*, " eſpecially towards its lower end, and they are " chiefly on that ſide of the Gut that is oppoſite " to the adheſion of the Meſentery. Where they " are, they are not ſingle, but a knot or cluſter " of them together, whence (as alſo from their

“ uſe) he reckons them in the number of *conglomerate* glands. They are thus in knots in the “ ſmall Guts; but in the *Cæcum*, *Colon* and *Rectum* “ they ſtand ſingle, but are larger than the other, “ with every one a pore in it likewiſe. Theſe “ are almoſt as big as a Vetch (and of the ſame “ ſhape) but thoſe in the ſmall Guts are but about “ the bigneſs of Millet. He thinks the office of “ thoſe in the *ſmall* Guts is to ſeparate a double “ ſort of liquor, *viz.* a ſubviſcid and glutinous “ *ſerum* from the Arteries, and a nitro-aereous “ ſpirit from the Nerves, (according to Dr. *Mayow*'s opinion) “ which two being mixt together make a fermentative liquor for the perfecting of chylification in the Inteſtines. But “ thoſe in the *thick* Guts, *he ſays*, ſerve for little “ elſe but to ſpue out a clammiſh humour, by “ means whereof the Guts are fenced againſt the “ hardneſs of the excrements, *&c.* and alſo the “ particles of the excrements themſelves are “ thereby glued together, as it were, into a due “ conſiſtence. Yet he ſuſpects there is ſomething “ of a nitro-aereous ſpirit alſo mixed with this “ humour, and thinks it moſt probable that the “ *flatus* in the *Colon* owe their origin thereto.] Thus he.

Veins. As to their *Veſſels*, the *Veins* ſpring from the *Porta*, but not all of them from the ſame branch: For the *duodenalis ſurculus* is ſent into the *Duodenum*, and the *Hæmorrhoïdalis interna* to the left part of the *Colon* near its ending, which running downwards from thence under the *Rectum* is inſerted into its end or *anus*; as the *dexter meſentericus* is ſent to the *Jejunum*, *Ileum*, *Cæcum*, and the right part of the *Colon*. *Epiploïs poſtica* is inſerted into the middle part of the *Colon*, which marcheth acroſs under the Stomach. Beſides theſe, a ſprig from the *ramus hypogaſtricus* of the *Vena cava* is ſent to the Muſcles of the *inteſtinum Rectum*, which maketh the *external hæmorrhoidal.*

Their Uſe. The *Uſe* of theſe Veins inſerted into the Inteſtines the Ancients thought to be, both to carry venal bloud to them for their nouriſhment, and alſo to receive the Chyle out of them and carry it to the Liver there to be turn'd into bloud. As to the firſt uſe, 'tis certain (by the circulation of the bloud) that theſe Veins carry nothing to the Guts; but the blood that is in them, is all received from the Arteries there, to be carried back towards the Liver and ſo to the Heart: but as to the latter, there are ſome learned Anatomiſts that ſtill think, though the greateſt part of the Chyle is received by the *venæ lacteæ*, yet that ſome part is ſuckt in by theſe Veins, that it may be more readily conveyed into the maſs of bloud. But this opinion is exploded by others as learned and more numerous, who deny any ſuch office to them, to whom I ſubſcribe.

Beſides theſe ſanguineous Veins there are another ſort of Veins inſerted (more or fewer) into all the Guts, called *Lacteal*, but of them we will treat in a diſtinct Chapter.

Arteries. The *Arteries* ſpring partly from *ramus cœliacus inteſtinalis*, partly from both the *meſentericæ*. To the *Duodenum* and the beginning of *Jejunum*, a ſprig is ſent from the right *ramus cœliacus*: but to the reſt of the *Jejunum*, to *Ileum*, *Cæcum* and the right part of *Colon*, *meſentericus ſuperior*; to the left part of *Colon*, and to the *inteſtinum Rectum*, *meſentericus inferior*. This laſt, paſſing along the *Rectum* to the *Podex*, makes the *internal hæmor-*

rhoidal Arterie, as ſome branches from the *arteria hypogaſtrica* make the *external.* Laſtly, *epiploïs poſtica*, which riſeth from the lower part of *arteria ſplenica*, (which is the left branch of *arteria cœliaca*) is ſent to the middle part of the *Colon*, which lieth under the Stomach.

Their Uſe. Their *Uſe* is to convey nouriſhment and warmth to the Guts; and when the Body is morboſe, to carry thither the impurities of the bloud, upon a purge taken, or critically, ſo to paſs out by ſtool. Yea, 'tis very probable, according to *Peyerus* his opinion before-cited, that ſuch Arteries as terminate in the glands above-deſcribed, do ſpue out through them into the Guts, even in a healthful ſtate, that ſlimy humour that bedaubs the inſide of them.

Nerves. *Nerves* they have from the inferiour ramifications of the *Intercoſtal* or ninth pair. The *Duodenum* hath ſome twigs from the upper branch of the *ramus meſentericus* called *ſtomachicus*, which go alſo to the *Pylorus*. All except the *Rectum* have many twigs chiefly from the *plexus meſentericus maximus*, and ſome alſo from other Meſenterical *plexus* of the Intercoſtal pair; but the *Rectum*, with the lower end of the *Colon*, receive ſlips from the *plexus abdominis infimus* or *minimus*; and the utmoſt extremity of the Intercoſtal is inſerted into the *ſphincter ani*, whither alſo paſs three or four that ſpring from the bottom of *Os ſacrum*.

The periſtaltick motion. Theſe Nerves ſerve for the feeling, and for the periſtaltick or worm-like motion, of the Guts; which though it be obſcure and ſlow, yet becauſe it is continual, it had need of ſo great a number of Nerves or nervous Fibres as are beſtowed on the Inteſtines. Now this motion is in ſome meaſure

ſure performed by the oblique fibres, but eſpecially by the tranſverſe, whereby what is contained in them is driven from above downwards: unleſs it happen that the motion be inverted, as in the Iliack paſſion, in which they drive their Contents from below upwards. *Peyerus* thinks that even in a natural ſtate (at leaſt in the ſmall Guts) this motion is reciprocal, the contractions of the fibres being carried ſometime upwards, and ſometimes downwards; to the end that both the fermentative liquors may by this agitation be the more intimately mixed with the chylous maſs, and alſo the chyle the better diſtributed into the Lacteal veſſels. If it were otherwiſe, the deſcent of the chyle, he thinks, would be ſo haſty, that every one would labour under the *cœliaca affectio.* And he quotes from *Wepfer* an Inſtance in an humane body, and alledges his own obſervation in all his diſſections of Creatures alive, for the confirmation of the truth hereof. But the learned and curious that would be further informed about the periſtaltick motion, may conſult Dr. *Gliſſon* in *cap.* 15. of his Book *de ventriculo & inteſtinus*, or Dr. *Charleton* in Sect. 3. of his third prelection before the College of Phyſicians. As for that other *Uſe*, which *Peyerus* aſcribes to the Nerves, of tranſmitting a nitro-aereous ſpirit through the Glands into the Guts, which mixing with that humour that is ſeparated from the Arteries makes a ferment for the perfecting of chylification in the Inteſtines, the Reader is at his diſcretion what opinion he will entertain of it.

The diviſion of the Guts.

Though the Guts be one continued Body from the *pylorus* to the *anus*, yet from the thickneſs of their ſubſtance, as alſo from their magnitude, figure,

gure, and variety of office, they are diſtinguiſh'd into ſeveral by Anatomiſts, and firſt into *thin*, and *thick*.

The differences between the *thin* and *thick* Guts are thus ſumm'd up by *Aquapendent* : "The "*thin* or *ſmall* are placed above, are long, equal, "round, rolled about in wreaths, full of wrin-"kles, interwoven with innumerable Veins, and "Chyle is found in them : On the contrary, the "*thick* are placed below, are ſhort, anfractuous, "without twiſting wreaths, and endued with "fewer Veins ; and the wrinkles or folds in the "Guts are expanded, and there reſult from them "certain receſſes or cells, and the *fæces* are found "in them.

The thin.

The *thin* poſſeſs the umbilical region and *hypogaſtrium* ; and in reſpect of their figure, ſituation, longitude and plenty of lacteal Veſſels, they are divided into three, *viz.* the *Duodenum*, *Jejunum* and *Ileon*.

1. Duodenum.

The firſt is called *Duodenum*, becauſe the Ancients thought it to be *twelve* inches long. But being chiefly verſt in the diſſection of Brutes, they were thereby deceived ; for though in Sheep, for inſtance, it be of that length, yet in Man it is but about four fingers. It is continued from the *pylorus*, from whence turning backwards and downwards it reaches to the middle of the greater and right end of the *Pancreas* ; and is none of it knit to the Meſentery, but to the fore-leaf of the Caul. It is thicker in its Membranes than the two following ſmall Guts, but its paſſage (becauſe ſtreight) is ſtraiter than theirs. Towards its lower end, (ſometimes higher, ſometimes lower) it has moſt commonly two ducts leading obliquely into it ; firſt the *ductus choledochus communis*, by which the bile from the Liver enters this Gut; and ſecondly a little below this, *ductus pancreaticus* (otherwiſe *Wirtſungianus*) by which the pancreatick juice paſſes hither from the *Pancreas* or Sweet-bread; though theſe two ducts are ſometimes joined into one, and both open by one mouth into this Inteſtine.

2. Jejunum. The ſecond is called *Jejunum*, or the hungry Gut, becauſe it is for the moſt part found empty; partly by reaſon of the multitude of milky Veins that enter it; partly by reaſon of the fermentation of the acrimonious choler with the pancreatick juice, which are both poured in juſt before its beginning. In length it is about eight feet. It beginneth on the right ſide, under the *Colon*, where the *Duodenum* endeth, and the Guts begin to be wreathed; and filling a good part of the umbilical region, eſpecially on the left ſide, it is continued unto the *Ileum*, from which it may be diſtinguiſh'd firſt by its emptineſs; ſecondly, by its greater number of Veins and Arteries, from which it looks reddiſh; thirdly, from the nearneſs of the folds or wrinkles of its inmoſt coat one to another, which are but about half an inch diſtant, whereas in the *Ileum* they are a whole inch or more; and laſtly, from the thickneſs of its coats, as being thicker than thoſe of the *Ileum*.

3. Ileum. The third is called *Ileum*, ἀπὸ τοῦ εἰλεῖσθαι, *à circumvolvendo*, from its many turnings and windings. It hath thinner membranes than the two before-going. It is ſeated under the Navel, and filleth both the *Ilia*. It is the longeſt of all the Guts, for in length it containeth above twenty feet; but it is the narroweſt of all, for it is but about a finger's breadth in diameter. It hath

fewer wrinkles than the *Jejunum*, and leſſer; about the lower end of it they ſcarcely appear.

At its beginning it is diſtinguiſhed from the *Jejunum* by all the four particulars above mentioned; and it is eaſily diſtinguiſhable from the *Cæcum* or *Colon*, being not joyn'd to theſe by a ſtreight duct, but tranſverſe. For the *Cæcum* and *Colon* are ſo united as to make one continued ſtreight Canal, whoſe lower ſide the *Ileon* aſcending pierceth, and into the latter whereof its inner Coat hangs looſly the length of half an Inch at leaſt, making the Valve it ſelf of the *Colon*, and is the limit that divides the *Cæcum* from it.

This *Ileum* oft falls down into the Cod, whence ſuch a Rupture is called Inteſtinal. And in this Gut happens the Diſtemper called *Volvulus* or *Iliaca paſſio*, wherein there is often vomiting of the dungy Excrement. This Diſtemper is cauſed herein, either when one part intrudes into another, or when the Gut is twiſted and twined like a Rope, or when it is ſtufft with ſome matter that obſtructs it: or laſtly, when it falls out of its place into the *ſcrotum*, as was noted before. And thus much of the firſt ſort of Inteſtines, *viz.* the *ſmall* or *thin.*

Their valves.

I have once and again made mention of the wrinkles in the inſide of the *Jejunum* and *Ileum*, which by modern Anatomiſts are called *Valvulæ conniventes.* Theſe happen from theſe Guts inmoſt Coats being much longer than the two other; for hence it muſt needs ever and anon wrinkle or bag out, and where it does ſo, ſtraiten the paſſage, by which means the Chyle deſcends more ſlowly, and thereby the Lacteal veſſels have the more time to imbibe it.

Now

The thick Guts. Now follow the *inteſtina craſſa*, the *thick* or great Guts; they are three in number alſo.

1. Cæcum. The firſt is called *Cæcum*, τυφλὸν, the *blind* Gut, becauſe one end of it is ſhut, ſo that the *Chyle* (or *fæces* rather) both goes in and comes out at the ſame Orifice. In Man it is about as thick, and but half as long, as your larger Earthworms ſtretched out at length; only its mouth that opens towards the *Colon* is pretty large. It owes its Origine rather to the *Colon* than the *Ileum*, and ſeems to be as it were an appendage to it. It is bigger in an Infant than in a Man. It is not tied to the Meſentery, but being placed in the Cavity of the right *os Ilium*, by its end it is joyned to the right Kidney, the *peritonæum* coming between. In ſound perſons it is generally empty. In four-footed Beaſts it is always full of Excrements. Apes have it larger than a Man, Dogs larger than Apes; but Conies, Squirrels, and Rats, largeſt of all, if you conſider the proportion of their Bodies. Its uſe is very obſcure in Men, being ſo very ſmall and commonly empty. But in grown *fœtus*'s, or Infants new born, it is full of Excrement, for which it ſerves as a Store-houſe till after the birth that they go to ſtool. And in ſuch Animals as have it large, (according to Dr. *Gliſſon*) it ſerves for a Bag or ſecond Ventricle, wherein the prepared Aliments may be ſtored up and ſo long retained, till a richer, thicker, and more nutritive juice may be drawn from them.

2. Colon. The ſecond is *Colon*, κῶλον, either *quaſi* κοῖλον, *cavum*, becauſe it is the *holloweſt* or wideſt of the Guts; or elſe ἀπὸ τοῦ κωλύειν, *ab impediendo*, becauſe it *detaineth* the Excrements. It hath its beginning at the *os Ilium* on the right ſide, and

aſcending by its Spine it arrives at the right Kidney; to which parts it is annex'd by a membranous connexion. From thence bending leftways it creeps under the Liver by the Gall-bladder, (which tinges it there a little yellowiſh) to the bottom of the Stomach, to the whole length whereof it is tied by the mediation of the fore Leaf of the Caul, as it is knit alſo to the *Pancreas* and Loins by the mediation of the hinder Leaf. Then it comes to the lower part of the Spleen, and is knit to it. Then touching the left Kidney, and adhering firmly to it by Fibres, it comes to the left *os Ilium*; from which deſcending by the left Groin to the *pelvis*, it embraceth the bottom of the Bladder behind on each ſide. Afterwards it aſcends upwards by the right Groin near the place from whence it firſt took its riſe; and thence marching back again towards the left ſide, and running it ſelf in betwixt the *Ileum* and Back-bone, it reaches to the top of *os Sacrum*, and there unloads it ſelf into the *Rectum*. Its length, according to Dr. *Gliſſon*, is about ſeven feet; others reckon it ſhorter. It goeth almoſt quite about the *Abdomen*, next to the Muſcles, that it may be the better compreſſed by them for avoidance of the Excrements. *Diemerbroeck* has an ingenious reaſon why it ſhould paſs under the Stomach, *viz.* That as Chymiſts judge no digeſtion more natural, than that which is performed by the heat of Dung, ſo the heat of the Excrements in the *Colon* does help the coction of the Stomach.

Its Cells and Ligament.

It is not of one continued equal width, but at about every two or three Inches diſtance it is more contracted, being ſomewhat furrow'd on the outſide and ridged on the inner, whereby the Gut is divided into ſeveral *Cells*. This comes to paſs partly indeed from the inmoſt Coat's exceeding the middle and outmoſt ſomewhat in length; but chiefly from the *Ligament* (which is half an inch broad) that runneth on the upper and middle part of this Gut all along, and is much ſhorter than the membranes of the Gut, as appeareth when it is cut through here and there; for then the Gut may be ſtretched out to near half as long again. The *Uſe* of theſe *Cells* is to hinder the flowing of the excrements into one place, which would compreſs the parts adjacent; as alſo for the ſlower paſſage of the *fæces*, that we may not have a continual and haſty need of going to ſtool. On its outſide, eſpecially from its paſſing by the Spleen to its joyning to the *Rectum*, it has a great many fatty knots, which ſerve to moiſten and lubricate it, that the *fæces* may paſs the more glibly. The *Rectum* alſo has ſuch like, for the ſame reaſon.

Its Valve. It hath a *Valve* where it is joined with the *Ileum*; which Valve is nothing elſe but the inmoſt coat of the *Ileum* propending or hanging out flaggy into the *Colon*, (as was noted before :) For its ſhape, *Spigelius* compares it to the *ſigmoides* in the right *ſinus* of the Heart. This Valve ſo ſtoppeth the hole which is common to the *Ileon* and *Colon*, that flatuoſities cannot aſcend from this latter into the former, much leſs excrements regurgitate. But if the periſtaltick motion of the Guts be inverted, (as in the Iliack Paſſion) ſo that the inmoſt coat of the *Ileum* be drawn back from its depending into the *Colon*, the excrements of the *Colon*, yea Clyſters themſelves may aſcend up thro' the ſmall Guts into the Stomach, and be thrown up by vomit.

The third is *inteſtinum Rectum*, the *ſtreight* Gut. 3. Rectum. This hath its beginning at the firſt *vertebra* of the *Os Sacrum*, where the *Colon* endeth; and paſſeth ſtreight downwards to the extremity of the *Coccyx*. It is faſt tied on its *back-ſide* to both theſe bones, by mediation of the *Peritonæum*, to keep it from falling out; and on its *fore-ſide* it grows in *men* to the neck of the Bladder, (whence in the pain of the Stone there, there generally happens a *teneſmus* or continual inclination to go to ſtool) and in *women* to the neck of the Womb: but in both there is a muſculous ſubſtance that comes between. It is a foot in length, not ſo wide as the *Colon*, but its Membranes are thicker.

At its lower end, (called the fundament,) it has a Sphincter Muſcle, by the help whereof it is cloſe purſed up, to hinder the continual exit of the *fæces*. But in going to ſtool the ſame is partly voluntarily relaxed, and partly forced open by the excrements themſelves whilſt they are ſqueezed or forced down through the compreſſion of the Guts by the contraction of the Abdominal Muſcles. *Its Sphincter-Muſcle.*

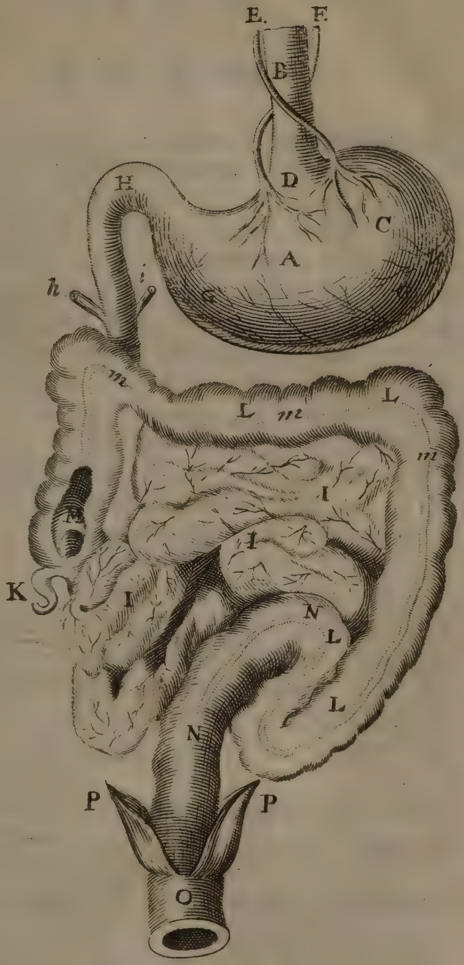
This Gut (eſpecially its inner Membrane) uſually bags a little out in ſtraining at ſtool, or upon taking Aloetick Purgers, yea ſometimes ſo much, that it requires an artificial putting up again.

As for the *hæmorrhoidal* Veins and Arteries, that are inſerted into the *anus*, we have given an account of them before in this Chapter; as we ſhall do of the *Muſcles* belonging to it, in Book V. *of the Muſcles*, Chap. 19.

The Explication of the Figure.

A *The Stomach.*
B *The Gullet or* Oeſophagus.
C *The left and larger part of the Stomach.*
D *The upper Orifice of the Stomach.*
E *The right external Nerve of the ſixth pair (Dr.* Willis's *eighth) encompaſſing the Orifice.*
F *The left external Nerve of the ſame pair.*
GG *The gaſtrick Veſſels creeping along the bottom of the Stomach.*
H *The lower Orifice of the Stomach, called* pylorus.
h *The inſertion of the Gall-paſſage into the* Duodenum.
i *The inſertion of the* Pancreatick duct *into the ſame.*
III *The* Jejunum *and* Ileum *with the Veſſels creeping along them.*
K *The* Cæcum.
LLLL *The* Colon.
M *The Valve in the beginning of the* Colon *opened.*
mmm *The Ligament holding together the Cells of the* Colon.
NN *The* Rectum.
O *The Sphincter of the* Anus.
pp *The Muſcles called* Levatores Ani.

TAB. III. pag. 60.



CHAP. IX.

Of the Meſentery.

The Meſentery. Its name and deſcription.

THE *Meſentery* is ſo called from its ſituation. For it has its Greek name μεσέντερον, (from whence the Engliſh is derived) from its being placed ἐν μέσῳ τῶν ἐντέρων, *in the midſt of the Inteſtines.* And it is a membranous part, ſituated in the middle of the lower Belly, ſerving not only for conveying ſome Veſſels *to* the Inteſtines, and others *from* them, but alſo tyes moſt of the Guts together ſo artificially, that for all their manifold windings they are not entangled and confounded. Which may be much wondred at, how the Guts being about nine or ten yards long, ſhould all but the *Duodenum* and part of the *Rectum* be comprehended by that circumference that is but a ſpan diſtant from the centre; for no longer is the Meſentery betwixt thoſe bounds. But it is almoſt of a circular figure, which is moſt capacious; and though it be narrow at its riſe, yet its circumference is wrinkled and enlarged into ſo many folds, as to be three Eils in length, whereby it comes the nearer to anſwer the length of the Guts.

Riſe.

It has a double Origine, an higher, and a lower. The higher is at the firſt, and the lower at the third *vertebra* of the Loyns.

Subſtance.

It is compoſed of two *common Membranes* which are propagated or continued from a duplicature of the *peritonæum*; and betwixt theſe two it has a third Membrane that is *proper*, (which was firſt diſcover'd by Dr. *Wharton*, in a young Maid) and is thicker than either of the other two, wherein the Glands are ſeated, and by which the Veſſels are conducted.

As for the *Fat* with which it is ſtufft betwixt its Membranes, though the ſame happen naturally to it, yet ought it not to be reputed a proper part of it. For not to mention that in Dogs, Cats, and ſuch like Animals, this part is very thin and tranſparent, even in humane *Embryo*'s it is without Fat; and in very lean Men there is but little, though in fat Men it be heaped up to ſo great a thickneſs.

Parts. The parts contained in the Meſentery are either common, or proper. The *common* are Veins, Arteries, Nerves, and Lympheducts. The *proper* are Glands and the *Venæ lacteæ*. Of theſe laſt we ſhall ſpeak in the next Chapter, of the reſt here.

Veins. The *Veins* are called *Meſaraicæ*; theſe ſpring from *ramus meſentericus dexter & ſiniſter*, branches of the *vena Portæ*. (Their uſe, as alſo that of the Arteries, was ſhewn in the Chapter before, ſpeaking of the Veſſels belonging to the Guts.)

Arteries. It hath alſo two *Arteries*, the one ſuperiour, the other inferiour, branches of the *arteria meſenterica*, which paſs as the Veins do.

Nerves. As for the *Nerves*, Dr. *Willis* deſcribeth them very accurately in his Book *de Cerebro*, cap. 25. which take thus in ſhort. " As ſoon as the *inter-*
" *coſtal pair* is deſcended as low as over againſt
" the bottom of the Stomach, it ſends forth on
" each ſide a large meſenterick branch, each of
" which is again divided and makes two *plexus* in
" each ſide. In the middle of theſe is the greateſt
" *plexus* of all, which (as he ſpeaks) is like the
" Sun amongſt the Planets; from which, twigs
" and

“ and numerous Fibres are diſperſed into all the “ parts of the Meſentery, which accompanying “ the ſanguiferous Veſſels in their whole proceſs, “ do climb upon and twiſt about them.] Others it hath from thoſe which ſpring from the *ſpinalis medulla*, between the firſt, ſecond, third, and fourth *vertebræ* of the Loins, (as *Spigelius* affirmeth.)

Lymphe-ducts.

Beſides theſe Veſſels known to the Ancients, about 35 years ago there were found out another ſort by *Tho. Bartholin* (a learned *Dane*) and called by him *vaſa lymphatica*, which he gives a large account of in *Append.* 3. to the *libel.* 1. *de Venis*, of which I ſhall give a *Compendium* here, becauſe the Meſentery abounds with them.

Their Figure.

They are of *figure* long and hollow like a Vein, but very ſmall and knotty, having very many Valves which permit the *lympha* or water contained in them to paſs to the chyliferous Veſſels (and many Veins) but hinder its return.

Colour and Subſtance.

They are of a pellucid and cryſtallin *colour*, like *hydatides*, *conſiſting* of a tranſparent and moſt thin skin, which being broken, and the *lympha* flowing out, utterly diſappears.

Number.

Their *number* cannot be defin’d, for they are almoſt innumerable.

Riſe.

As to their riſe, *Bartholin* ſpeaks uncertainly; but *Malpighius* affirms, that they always proceed from Glands; and *Steno*, that they always either ariſe from or are inſerted into Glands.

Inſertion.

As to their *inſertion* or ending, thoſe under the Midriff do diſcharge their liquor into the *receptaculum chyli*, (to be ſpoken of in the next Chapter.) Thoſe in the *thorax*, immediately into the *thoracick duct*. And thoſe of the Neck, Arms, &c. into the *jugular* Vein. *Bartholin* thought they all diſcharg'd themſelves into theſe three Chanels: but *Diemerbroeck* affirms, they open alſo into many other Veins; and quotes *Steno* noting that they empty themſelves into the jugular and other Veins; and alſo his Countryman *Frederick Ruyſch* writing, that by ligature and ſtructure of the Valves, he has plainly ſeen, that all the lympheducts in the Lungs do diſcharge their *lympha* into the ſubclavian, axillar, and jugular Veins.

Difference. *De muſc. & gland. p.*41.

Steno diſtinguiſhes them into three ſorts: for ſome from their firſt Origins (but what thoſe are, he cannot ſay) are diſperſed over the ſurface of the firſt Glands they approach unto; others run from the hollow ſide of one Gland to the gibbous of another; and a third ſort run from the hollow ſide of theſe latter, to the Veins into which they diſcharge their *lympha.* Whence (ſuppoſing this difference) an Inquiry may ariſe, Whether the lympheduct that paſſes out of the hollow ſide of the Gland, carry a more elaborated *lympha* than that which entred into its gibbous ſide? or whether only the quantity be encreaſed? I believe that into every Gland there enter an Artery, Vein and Nerve, and therefore that ſome new *lympha* is added to that which was brought in from the Lympheduct inſerted into it, which together therewith enters into the Lympheduct ariſing out of it; but that there is no further elaboration of the former *lympha*, which I think perfect at its entrance into the firſt Lympheduct.

What the Lympha

There has been much diſpute what this *lympha* which they carry, is. It ſeems to *Bartholin* to be meer limpid water; but to ſimple water there is added an alimentary liquor, or a thinner part of the Chyle,fit for Nutrition, thoroughly mixed with it. The former, he ſays, is caſt off either by ſweat, or other ways whereby water paſſes away; the later is circulated on. *Gliſſon*, that it is a liquor condens'd from the *halitus* of the blood (like Dew) driven into theſe Veſſels, and flowing back with the vehicle of the aliment brought by the Nerves. *Segerus* (and *Sylvius*) that it is the animal Spirits, or is made of them, which after they are diſtributed into all parts by the Nerves, are there partly conſum'd and diſſipated, and are partly condens'd into this water. *Diemerbroeck* quotes more Opinions beſides theſe, but rejects them all, and eſtabliſheth this of his own, *viz.* " That it is a fermentaceous liquor ſeparated from the ſerous part " of the blood in the conglobate Glands, yet not " ſimple, but impregnated with much fus'd and " volatile Salt, and alſo with ſome ſulphureous " particles; which when it is conveyed to the " *vaſa chylifera*, makes the Chyle thinner and " apt to dilate eaſily in the Heart; and when " to the *Veins*, prepares the venous blood (now " too thick) for a quick dilatation in the Heart.] This *lympha*, whatever it be, (or be for) differs from the *ſerum*; for if one gather a little of it in a Spoon, and let it ſtand, without ſetting it on the Fire, it will turn into a jelly, which the *ſerum* will not do.

And thus much of the *Lympheducts* (with their *lympha*) in general; as to thoſe particularly of the Meſentery, ſome only paſs through it from other parts, as from the Liver, &c. but many have their riſe in it, and both the one and other are emptied into the *receptaculum chyli.*

The Glandules of the Meſentery.

It hath many little ſoftiſh *Glands* fix'd in its proper Membrane, cover'd on each ſide by the two common ones, and beſet with Fat. If you cut them in two, and preſs them with your Fingers, you may ſqueeze a whitiſh liquor out of them. They are whiter in young people than in old. In number they are very uncertain; in Man fewer and ſmaller alſo than in other Creatures. The biggeſt by much is at the riſe or centre of the Meſentery, (called by *Aſellius*, *Pancreas)* into which all the *venæ lacteæ* are inſerted. Of its uſe, as alſo of the leſſer, we ſhall ſpeak in the next Chapter, when we come to treat of the paſſage of the Lacteals. We will only note here, that when theſe Glands grow ſcirrhous, or are any ways obſtructed, ſo that the Chyle cannot tranſcolate through them, there follows a *fluxus cœliacus*, or *chyloſus*, which continuing, there enſues an Atrophy, and the party dies tabid. And perhaps from the ſame Obſtruction in the Glands, the courſe of the lympha being ſtopped, and by that means the Lymphe-ducts that paſs from one Gland to another being over-extended and burſting, an *Aſcites* is partly cauſed.

The diviſion of the Meſentery.

It is but one, yet becauſe of its different thickneſs it is *divided* by ſome into two parts.

The one they call *Meſaræum*, μεσάραιον, becauſe it is placed ἐν μέσῳ τῶν ἀραιῶν (*ſubaudi* ἐντέρων) *in the midſt of the ſmall* Inteſtines, which it knits together; and this is the thicker part of it. The other being the thinner, they call μεσόκωλον, being ſeated ἐν μέσῳ τοῦ κώλου, *in the midſt of the Colon*, to which it is joyned in its whole length, ſave only in the *Colon*'s paſſage under the Stomach; and in its loweſt border it adheres to a part of the *Rectum*.

Diſeaſes incident to this part are reckoned up by Dr. *Wharton* to be theſe; thoſe of *intemperies*, ſtraitneſs or obſtruction, tumours of whatſoever kind, (*Scirrhi*, *Scrophulæ*, *Strumæ*) Inflammations, Abſceſſes, Ulcers, and Tone vitiated. Of all which the Reader that deſires fuller information, may be ſatisfied by the ſaid learned Author, in his *Adenographia*, *cap.* 11. *Diſeaſes.*

CHAP. X.

Of the Venæ lacteæ, Glandulæ lumbares, Receptaculum commune, ductus chyliferus Thoracicus, *and of the motion of the Chyle.*

Venæ lacteæ, the *Milky veins* (ſo called from the *white* colour of the Chyle which they carry) were not diſcover'd (as ſuch) till the year 1622. when *Caſpar Aſellius* found them out in diſſecting a Live-dog well fed. But ſince him many others have made a more accurate diſcovery of them than he. Venæ Lacteæ. *Their name.*

They are ſlender pellucid Veſſels, having but a ſingle Coat, diſperſed in great numbers through the Meſentery, and appointed for the carrying of the Chyle. *Definition.*

Their *riſe* is from the inmoſt Membrane of the Inteſtines, where their Mouths are hid under a kind of a ſpongy cruſt or *mucus*, through which by the preſſion of the Guts the Chyle is ſtrained and received by the mouths of theſe veſſels. From whence they proceed the readieſt way to ſuch Glandules of the Meſentery as are neareſt to them: *Riſe.*

them: but in their paſſage many ſmall ones uniting to one another do commonly grow into one large trunk; namely, a pretty way before they inſinuate themſelves into the Gland, to which we ſaid they were going. But in their very entrance into the Gland, or a little before, this trunk ſeparates again into new branches, more and ſmaller than the other. And thus far they are called *radicales*, or *primi generis*, of the firſt ~~kind. Out of the Gland there ſpring again new~~ capillary ones, which by and by meeting together make one trunk again as before, which keeping its courſe towards the centre of the Meſentery, enters as many Glands as lye in its way, being divided into new branches juſt before its entrance into each Gland, as before. But whilſt all the trunks bend one way, they alſo meeting with one another, do in proceſs ſeveral of them grow into one. And at length all the trunks arrive at the great or middle Gland of the Meſentery (called improperly *Pancreas*) which moſt of them enter into, but ſome of them paſs over its Surface, and by and by they all empty themſelves into the great or common receptacle of the Chyle that lies behind the ſaid Gland, thoſe that were inſerted into it riſing out of it in like manner as they did before out of the leſſer Glands. As they run from one Gland to another, they are called *ſecundi generis*, or of the ſecond kind: And from their having paſt all the Glands to their opening into the common receptacle, &c. they are called *tertii generis*, or of the third kind.

Glandulæ lumbares. By the way we cannot omit to take notice of thoſe three Glands which *Bartholin* calls *Lumbares*, from their being ſituated upon the *Loins*, and which he thus deſcribes. * Two of them which are larger, lye one upon the other betwixt the deſcending *Cava* and *Aorta*, in that Angle which the Emulgents make with the *Cava*. The third being ſmaller ſtands over theſe, under the appendices of the Diaphragm. They have communication, or are knit one to another by ſmall lacteal branches, eſpecially the two larger.] He once thought them to ſupply the place of the common Receptacle in Man; that not being ſo plain in him as in ſeveral Brutes. But ſince a Receptacle is acknowledg'd as well in Men as Brutes, Dr. *Wharton*'s Opinion concerning their uſe ſeems more probable, *viz.* That they ſupply the place of thoſe larger Glands that are found in the Meſenteries of Brutes, but are not natural to Men; And for this reaſon he preſumes, that all ſuch Animals as want thoſe greater Glands in the Meſentery, have theſe *Lumbares* as well as Men.

* *Anat. p.* 108. *Edit.* 74.

Receptaculum commune.

The *common Receptacle* is called *Receptaculum Chyli Pecquetianum*, from *Pecquet* who firſt found out both it and the *ductus Thoracicus* (whoſe beginning it is) in the year 1651. I mean he was the firſt that aſſigned the true uſe unto them, but both were obſerved in Horſes by *Bartholomæus Euſtachius* about an hundred and thirty years ago, as appears in a Book he writ, 1564. *pag.* 301. of the *Vena ſine pari*, wherein he has theſe words, (as cited by Dr. *Wharton.*) *From this notable left trunk of the throat,* (viz. *the* Subclavian Vein) *there ſprings a great branch, which beſides that it has a ſemicircular door,* (or valve) *in its Origine, is moreover white, and full of a watry humour; and not far from its riſe it* *is divided into two, that after a little ſpace unite again into one, which ſending forth no branches deſcends by the left ſide of the* vertebræ, *and having paſt through the Midriff runs down to the middle of the Loins: where becoming larger, and folding about the great Artery, it has an obſcure ending, which I have not as yet well diſcover'd.*] Here we have a clear deſcription of them, only that is the beginning which he takes for the end; and contrarily. It is called the *common* Receptacle, becauſe it receives both the Chyle and Lympha promiſcuouſly; though ſome call it the Receptacle of *the Chyle* in particular: but without reaſon; for it might as well be called *Receptaculum Lymphæ*, as *Chyli*, for that the *Lympha* paſſes not only with the Chyle, but after this is all diſtributed, the *Lympha* ſtill continues to glide into it and to aſcend by the *ductus chyliferus Thoracicus*, which might as well be called *Lymphaticus* for the ſame reaſon.

Its ſite, and ſubſtance. It is *ſeated* under the Celiack Artery and Emulgent Veins, about the middle diſtance between the Kidneys and *capſulæ atrabilariæ*, upon the *vertebræ* of the Loins, but for the moſt part rather toward the left ſide. *Pecquet* and *Caſp. Bartholin* ſay, 'tis ſeated betwixt the tendons (or *appendices*) of the Diaphragm, by the motion whereof it is preſſed and milked, as it were, and its contents propelled. It is of a membranous, but thicker *ſubſtance* in Men than in Brutes, but not ſo capacious, ſeldom being ſo large as to admit ones Finger's end. Out of it there ſprings a duct that preſently aſcends up into the *Thorax* (behind the deſcending trunk of the *Arteria magna*) where it begins to be called *ductus Thoracicus*, but, according to *Sylvius*, it might more fitly be called *Spinalis*, ſeeing it runs along the inſide of the *Spina dorſi.* And now though it be paſt out of the *Abdomen* (of the contents whereof we are here treating) yet we will trace it through the middle Ventricle to the Heart whither it conveys its liquor, for the ſame reaſon that being above to ſpeak of the Stomach, we thought it beſt to deſcribe the Gullet alſo, which is an appendage to it, and by which the Meat deſcends into it.

Ductus chyliferus thoracicus.

This *Duct* then having paſt the Midriff, marches further upward under the great Artery till about the fifth or ſixth *vertebra* of the *Thorax*, where it turns a little aſide from under it to the left hand; and ſo underneath the intercoſtal Arteries and Veins, and the Gland *Thymus*, it aſcends to the left ſubclavian Vein, into whoſe lower ſide it opens, juſt there where the left jugular Vein enters into it on the upper ſide, ſo that their Mouths face one another. But it opens not into this Vein with any large Orifice, but by ſix or ſeven little ones, which are all cover'd in the Cavity of the *Subclavia* with one broad Valve, looking towards the *Cava* from the Shoulder, whereby there is granted to the Chyle and *Lympha* a free paſſage out of the *ductus Chyliferus* into the *Subclavia*, but their return (or of Blood with them) out of the Vein into the Duct is prevented. This Duct ending thus in the Subclavian vein, the Chyle that it conveys into it paſſes with the Blood (returning by the *Cava*) into the right ventricle of the Heart, where we will leave it, and return to the *Venæ lacteæ* again; having only obſerved, that this Duct has many ſemilunar Valves that hinder the aſcending Chyle and *Lympha* from gliding back again; which Valves are manifeſt by this, that the Chyle contained in the Duct may eaſily by the Finger be preſſed upwards, but by no means downwards: or if one make a hole in it, the liquor tending from beneath upwards will flow out at it; but that which is above it, is ſo ſtopt by the *Valves*, that it cannot be made to deſcend by it.

The difference between the Venæ lacteæ, *and the ordinary meſaraical Veins.*

The *Venæ lacteæ* differ from the ordinary Meſaraick veins:

Firſt, in *bigneſs*; for the Meſaraicks are bigger, but the *Lacteæ* are far more in number. Which was neceſſary, in that more Chyle muſt paſs by them the way that has been ſpoken, to make Blood of, for the nouriſhment of the whole Body, than there can be Blood remaining from the nouriſhment of the Inteſtines only, to return by the Meſaraicks to the Liver.

Secondly, they differ in *colour*, by reaſon of the great difference in colour of the liquors they contain. The Lacteals are white and limpid, by reaſon of the whiteneſs and clearneſs of the Chyle that is conveyed by them; but the Meſaraicks are of a dusky blackiſh colour.

Thirdly, they differ in their *inſertion*; for the Lacteals, as has been ſaid, are inſerted into the great Gland of the Meſentery, from whence they run forwards to the common receptacle, but the Meſaraicks all terminate in the Liver.

Whether they differ from the ductus Lymphatici.

But though there be this plain difference betwixt theſe two, yet there is not the like betwixt the *Venæ lacteæ* and the *Lympheducts*; for many good Anatomiſts do affirm, that before and after the diſtribution of the Chyle, not only the Receptacle and *ductus thoracicus* contain *Lympha*, but that they have ſeen even the *Venæ lacteæ* themſelves do ſo too, and queſtion whether the ſame veſſels be not, in the Meſentery, common Conduits for both liquors. I believe that the *Lacteæ radicales* (or *primi generis*) are truly diſtinct from the Lympheducts, but heſitate as to thoſe *ſecundi*, *& tertii generis*.

Their Valves.

They have a pretty many *Valves*, but not ſo many as the *ductus Thoracicus*. They may be diſcover'd the ſame way as we intimated thoſe of the *Ductus* might, *viz.* that if they be preſſed towards the great Gland, they are preſently emptied; but if one preſs them from the Gland towards the Inteſtines, the Chyle will ſtop, and cannot be driven thither.

The reaſon of the motion of the Chyle.

By what has been ſaid, it ſufficiently appears, what way the Chyle paſſes from the Guts to the Heart; but there is another thing to be enquired into, *viz.* what ſhould be the reaſon or cauſe of this motion. This we cannot impute to the *attraction* of the *Lacteæ*, as if they ſuckt up the Chyle out of the Guts, for ſuch elective attraction has been a long time exploded: but the true reaſon is, the preſſure of the Guts, whereby the Chyle is ſqueezed through their ſpungy inner Cruſt or Coat into the Mouths of the *Lacteæ*. Which preſſure proceeds *partly* from that undulating contraction of the Guts that is performed by their own Fibres, which one may plainly obſerve in Coneys, *&c.* opened alive; and *partly* from their being heaved to and again by the Muſcles of the *Abdomen*, and the *Diaphragm* in reſpiration. Now as ſoon as the Chyle is once got into the *Lacteæ*, we need not be ſolicitous for a reaſon of its further progreſs to the Receptacle and up the Thoracick Duct; for what is once got in, cannot ſlide back again, by reaſon of the Valves; and ſeeing ſo long as there is any Chyle in the Guts, there is no ceſſation of its being preſt into the *Lacteæ*, that which comes behind muſt needs drive forward that which went before, by which it is made to aſcend to the Heart. Which aſcent is alſo helped by the *Lympha* that mixes with it in the Receptacle and Duct, not only in that it is thereby dilated, but more eſpecially from that motion which is impreſſed upon the *Lympha* from the pulſation of the Heart, whereby it is made to circulate by the Lympheducts, as well as the Blood by the Veins.

CHAP. XI.

Of the Liver.

The Liver. Its ſituation. THE *Liver* is ſeated in the upper part of the *Abdomen*, namely about a finger's breadth diſtance from under the Midriff, in the right Hypochondre, (under the ſhort Ribs) which, being of a great bulk, it quite fills in a manner, and reaches from thence towards the left ſide, a little beyond the *Cartilago enſiformis*, or pit of the Stomach. Its upper ſide is convex or round and ſmooth, the under is hollow, lying on the right ſide of the Stomach and *Pylorus*, *&c.* Its lower edge reaches below the ſhort Ribs on the right ſide, and very near as low as the Navel before.

Lobes. In Dogs and many other Brutes, it is plainly divided into divers *Lobes*; to which that Man's might ſeem to correſpond, many of the Ancients reckon'd it to have four Lobes, called *portæ*, *menſa*, *ſa*, *gladius* and *unguis*; and *Galen* deſcribes five: But *Columbus* and *Gliſſon* do more truly affirm it to be undivided, or continuous: onely there is a little protuberance in its hollow ſide, to which the Caul is knit, which *Spigelius* called a Lobe, and from him others; but it is improperly called ſo, and is not at all like the Lobes in the Livers of Brutes.

It has three *Ligaments* (properly ſo called) which according to Dr. *Gliſſon* (*de Hepate*) are theſe. The firſt is called *Suſpenſorium*, becauſe it *ſuſpends* the Liver, or ties it up to the Diaphragm; it is broad, membranous and ſtrong, ariſing from the *Peritonæum*, and is not onely fixed to the outer membrane of the Liver, but does indeed make it, and deſcends even into the Liver, and is ſtrongly faſtened to the common ſheath or *involucrum* of the *Vena cava* (there where the umbilical Vein is continuous to it.) By this ſtrong inſertion it is the more able to bear up the great weight of the Liver.

Ligaments.

The ſecond is the *Vena umbilicalis*, which after the birth, cloſes up and hardens into a Ligament. It is directly oppoſite to the former. It paſſes out of the hollow ſide of the Liver by the *Porta*, and terminates in the Navel. By this the Liver is kept from aſcending upon the motion of the Diaphragm upwards in reſpiration.

The third is that whereby the Liver adheres to the *Cartilago enſiformis*. This is thin and flaccid, but yet ſtrong, broad and doubled, ariſing from that Membrane wherewith the Liver is encompaſſed, (according to *Spigelius*) of which it is a duplicature (according to Dr. *Gliſſon*.) This hinders it from fluctuating to one or t'other ſide, or towards the Back.

Beſides theſe three Ligaments, it has ſeveral other connexions to the neighbouring parts, by the Veſſels that come into it, or go out of it; but thoſe would improperly be called Ligaments.

Membrane. It is covered with a very thin *Membrane* that ſpringeth from the firſt Ligament (as was ſaid before) which cleaveth firmly to the ſubſtance of the Liver. It is ſometime ſeparated from it by a watriſh humour, iſſuing out of the capillary Veins, or Lymphaticks, whereby watriſh Puſtules, by the Grecians called ὑδατίδες, are ingendred. If theſe break, the water falleth into the cavity of the Belly, and in part at leaſt cauſeth that kind of Dropſie called *Aſcites*.

Subſtance. Its *Subſtance* (beſides the veſſels) has uſed by moſt Anatomiſts to be called *parenchyma*, as if it were nothing but an *Affuſion* of ſome certain humour about the veſſels, and there concreted. And becauſe it looks red, they have eſteemed it to be bloud. But red is not its proper colour; as Dr. *Gliſſon* thinks; nor is it parenchymatous, as *Malpighius* teaches. For the former ſays, That its redneſs is only borrowed from the great quantity of bloud that is tranſcolated through it out of the *Porta* into the *Cava*, its proper colour being pale, a little yellowiſh, ſuch as the Liver is of when 'tis boil'd; and yet that yellowiſhneſs ſeems to be cauſed by the Bile which is ſeparated in it: And the latter eſteems it to be glandulous, and naturally of a white colour; whoſe obſervations by the Microſcope, being curious, I ſhall expreſs in ſhort, as they are contained in his *lib. de Hepat. capp.* 2, 3, 5. " He ſays, That 1. the *Parenchyma*
" (ſo called) of the Liver in Man is framed of
" innumerable Lobules, which have commonly
" each of them ſix ſides like a Die, and conſiſt

" of ſeveral little ſix-corner'd Glands like the
" ſtones of Grapes, (ſo that the Lobules look
" like bunches of Grapes) and are each cloathed
" with a proper circumambient Membrane, and
" are joyned to one another by Membranes con-
" tinued from the circumambient, and running
" tranſverſly ; yet ſo, as that certain *rimulæ* or lit-
" tle chinks reſult from the joyning of the ſides of
" the Lobules together. 2. That the whole bulk
" of the Liver conſiſts of theſe little Grape-
" ſtone-like Glands, and of divers ſorts of Veſſels ;
" and hence, that they may perform together a
" common work, Reaſon concludes it neceſſary,
" that there be a commerce betwixt theſe Glands
" and Veſſels, though Senſe cannot diſcern the
" very ſlender extream twigs of the Veſſels that
" are inſerted into the Glands. 3. That the
" little branches of the *Porta*, *Cava*, and *Porus*
" *bilarius*, do run through all even the leaſt Lo-
" bules in an equal number : that the *Porta* does
" the office of an Artery, and has ſo great ſo-
" ciety with the *Porus bilarius*, that both their
" twigs are ſtraitly tyed together in the ſame
" cover. 4. That the ſhoots of the ſaid Veſſels
" are not joyned by Anaſtomoſes, but that the
" Grape-ſtone-like Glandules, making the chief
" ſubſtance of the Liver, are a *medium* between
" the importing and exporting Veſſels, ſo that
" by the interpoſition of theſe, the Importers
" transfuſe their liquor into the Exporters. From
" theſe Obſervations he concludes the Liver to
" be a *conglomerate Gland*, ſeparating the Bile. —
" And becauſe it is uſual for the conglomerate
" Glands to have, beſides Arteries, Veins, and
" Nerves, a proper excretory Veſſel (as in the
" *Pancreas*, *Parotides*, *&c.*) diſperſed through
" their

"their ſubſtance,receiving and carrying away the "humour ſeparated in them, this kind of Veſſel "in the Liver is the *Porus bilarius* with the Gall-"bladder.] Which account of the *parenchyma,&c.* of the Liver, though new, and far differing from any heretofore delivered by others, is now received generally among Anatomiſts. And whereas ſeveral Lymphatick veſſels are ſaid to ariſe from the Liver, and therefore it may ſeem to have a double excretory veſſel; he thinks, that ſeeing in other places the Lympheducts uſe to ariſe not from conglomerate but conglobate Glands, therefore they do not truly ſpring from the Liver it ſelf, but from thoſe conſpicuous conglobate Glands that are in the hollow of the Liver under the *involucrum* or *capſula*, where the trunks of the *Porta* and *porus bilarius* enter into it. Even as *Steno* obſerves, that the Lympheducts which ſeem to ſpring from the *Parotides*, do not indeed ſpring from them, but from a conglobate Gland that is contiguous to them.

Veins. It hath two ſorts of *Veins*. In its upper part the *Vena cava* entreth into it, and ſpreads it ſelf all through it in the lower as well as upper part. Into the lower ſide the *Vena portæ* is inſerted, whoſe branches likewiſe run through its whole *Parenchyma*. Of both theſe Veins more fully in the two following Chapters.

Arteries. It has but very ſmall and few *Arteries*, for the *Porta* ſerves it for an Artery, bringing blood to it. Thoſe which it has, do all ariſe from the right branch of the *Arteria cœliaca*, (called *Hepaticus*) which being ſuſtained by the Coats of the Caul, aſcends to the hollow of the Liver juſt by the *Vena portæ*, on whoſe Coat, with the Bilary veſſels, and the Membrane of the Liver, it is wholly ſpent. For, as was ſaid, the *Parenchyma* (ſo called) is nouriſhed by the blood brought by the *Porta*.

Nerves. It has *Nerves* from the Intercoſtal pair, namely one from the ſtomachical branch thereof, another from the meſenterical (called *Hepaticus.*) But the Nerves are extended only to the Membrane and veſſels of the Liver, (as the Arteries were) ſo that the *Parenchyma* has but a very dull ſenſe.

Lymphe-ducts. Till the *ductus Thoracicus Chyliferus* was found out, it was ſtill believed that the *Venæ lacteæ* were inſerted into the Liver, which was looked upon as the great Organ of Sanguification ; but now 'tis known for certain that no *Lacteæ* at all go to the Liver, but that thoſe veſſels which were taken for ſuch, are *Lymphatick* veſſels carrying from it a moſt limpid and pellucid juice. That they are diſperſed in the *Parenchyma* of the Liver, has not yet been obſerved ; nay, as was noted before, *Malpighius* believes they are not derived from the Liver at all, but from thoſe conglobate Glands that lye under the *Porta* at its ingreſs into the Liver, and ſometimes adhere to it, from whence taking their courſe chiefly along the Meſentery, they open themſelves into the *Receptaculum Chyli.* But ſuppoſing that they enter'd the ſubſtance of the Liver, leſt any one ſhould ſuſpect them to be Lacteals, for which they were a good while taken, after the Lacteals of the Meſentery were found out, but the common Receptacle and thoracick Duct were not as yet known ; I ſay, leſt any ſhould ſuſpect them to be Lacteals, and ſo to import Chyle to the Liver, let him ſatisfie himſelf with this Experiment, *viz.* let him in viviſection make a ligature about any one of them or more, and he will ſee them preſently ſwell betwixt the Ligature and the Liver, but be empty on that ſide towards the Receptacle. And the ſame will be more evident if he examine their *Valves* alſo, which open towards the ſaid Receptacle, but hinder any thing from coming back from thence to the Liver.

The Bilary Veſſels.

Concerning the *Bilary Veſſels* we ſhall forbear to ſpeak here, deſigning a particular Chapter for them, *viz.* ch. 14.

The Liver does not ſanguifie.

Hippocrates in *lib.* 4. *de Morb.* ſays, *The fountain of blood is the Heart, the place of Choler is in the Liver*, which comes very near the truth, as ſhall appear hereafter. But after him both the *Greeks* and *Arabs* generally held, that the Meſaraick veins received the Chyle from the Guts and brought it to the Liver, by which it was turned into Blood, which was carried from it into all the parts of the Body by the Veins. Yea and even ſince the *Venæ lacteæ* were found out, Anatomiſts believed that they all terminated in it, becauſe they judged it the fitteſt Bowel for Sanguification, preſuming that that task muſt be performed by ſome or other. But not to multiply Arguments for the confutation of ſo generally rejected an Opinion, this one may be ſufficient to evince its falſity, That none of the *Venæ lacteæ* are inſerted into the Liver, and conſequently no Chyle is imported into it whereof Blood ſhould be made. (How and where Sanguification is performed, we ſhall ſhew when we come to the Heart.)

Its true action.

The Liver then being diſcharged from Sanguification, its true action is to ſeparate the *Bile* from the Blood, which is brought plentifully to it by the *Vena portæ*. As to the manner of its ſeparation,

tion, ſome ſay it is meerly by colature, others think a Fermentation alſo neceſſary: but this is too intricate a Controverſie to enter upon here, and therefore waving it, I ſhall paſs on to ſpeak of the nature and uſe of the *Bile.*

The nature and uſe of the Bile.

The Ancients (amongſt whom was *Ariſtotle*) thought it to be a meer Excrement, and to be of no other uſe than by its Acrimony to promote the excretion of the Guts. And this Opinion prevail'd ſo long as it was believ'd that the Liver had a nobler action than meerly to ſeparate the Choler. But now it being found out that it has no other Office, it ſeems unlikely that ſo bulky a Bowel was made only for the ſeparation of a *meer Excrement*, and therefore 'tis believed to be a *Ferment* for the Chyle and Blood. This new Doctrine I ſhall give entirely out of *Diemerbroeck*, *p.* 154. "The Blood flowing into the "Liver by the *Porta* out of the Gaſtrick and Meſaraick veins (and it may be a little by the "Hepatick Artery) is mixed with an acrimonious, ſaltiſh, and ſubacid juice, (made in "the Spleen of the arterious Blood flowing thither by the Arteries, and of the animal Spirits by the Nerves) which is brought into the "*Porta* by the *Ramus Splenicus*. Now both theſe "being entred the Liver by the branches of the "*Porta*, by means of this ſaid acrimonious and "acid juice, and the ſpecifick virtue or coction of the Liver, the ſpirituous particles, both "ſulphureous and ſalt, lying hid in the ſaid venous Blood, are diſſolved, attenuated, and "become alſo a little acrimonious and fermenting; a certain thinneſt part whereof, like "moſt clear water, being ſeparated from the "other thicker maſs of the Blood by means of

" the conglobated Glands, plac'd moſtly in the " hollow ſide of the Liver, is carried from " thence by many Lympheducts, as has been " ſaid. But the fermentaceous Spirits of greater " Acrimony, mixed with the thicker and more " viſcid ſulphureous Juices, (for Sulphur is vi-" ſcid) & more ſtrongly boiling, whenas through " the clammineſs of the Juices in which they in-" here, they cannot enter the conglobated " Glands, nor from them the Lympheducts, and " yet through their fierce ebullition are ſepara-" ted from the Blood (as Yeſt from Beer) theſe " fermentaceous Spirits, I ſay, being ſever'd with " the Juice in which they inhere, become bitter, " and are called *Bile*. Which *Bile* being tranſco-" lated through the Grape-ſtone-like Glandules " into the roots of the *Porus Bilarius*, and of the " Gall-bladder, paſſes through them by the " *Ductus communis* into the *Duodenum* or *Jeju-* " *num*, where it is preſently mixed with the " Pancreatick juice, and both of them with the " alimentary maſs concocted in the Stomach, and " now paſſing down this way, which it cauſes " to ferment. And becauſe at its firſt entrance " it is more acrimonious, and has its vertue en-" tire, and ſo cauſes the greateſt ebullition with " the Pancreatick juice, hence the milky Juice " contained in the maſs concocted in the Sto-" mach, is moſt readily and in greateſt quantity " ſeparated in the *Jejunum*, and by innumerable " Lacteal veſſels, (which are more numerous in " this than the other Guts) it is moſt quickly " driven on towards the *Receptaculum Chyli*, and " this is the reaſon that this Gut is always ſo " empty. But in the following Guts becauſe the " Fermentaceous Spirits are a little pall'd, the

" effervefcency becomes ſlower and leſs efficacious, and the Chyle is more ſlowly ſeparated " from the thicker maſs; and therefore they " have fewer *Venæ lacteæ.* At length what remains of this fermenting matter is mixed with " the thick *fæces* in the thick Guts, where by its " Acrimony it irritates them to excretion.] Thus far that perſpicacious and judicious Anatomiſt. And indeed if the Liver have no other office but to ſeparate the Choler, it is by no means to be reputed an Excrement: for though the Liver do not ſanguifie, yet however it is to be eſteemed as a very noble part, ſeeing the Diſeaſes thereof are generally ſo dangerous, and wounds in it are ſo commonly mortal; and by conſequence that liquor which it ſeparates muſt have ſome noble uſe, and ſuch as is very neceſſary unto life.

CHAP. XII.

Of the Vena Portæ.

Vena Portæ.

THough it be the method of Anatomiſts uſually to deliver the Doctrine of all the Veins in a diſtinct Chapter or Book after the deſcription of the three Ventricles; yet ſeeing all the *Veins* ſeem (and by the *Galeniſts* have been affirmed) to have their root in the Liver, of which therefore we cannot but take notice; on this account we will here deſcribe their branchings within the *Abdomen*, ſeeing they are parts contained in it. Only in contradiction of *Galen*'s Opinion we deſire it may be noted, that their root is more properly ſaid to be in thoſe parts wherein they receive their blood from the Arteries, than in the Liver (or in the Heart) whither they convey it. Now we ſhall in the firſt place deſcribe the branchings of the *Vena portæ*.

Its Name. It hath this name from the two Eminences (called by *Hippocrates* πύλαι, *Portæ*, Gates) betwixt which it enters into the lower ſide of the Liver; and ſometimes, without the general name of *Vena*, it is called only *Porta.*

Origine. Some think that the *Vena umbilicalis* ought to be accounted its Root or Original, becauſe it is firſt formed in the *Fœtus* and inſerted into the *Porta.* But this Umbilical vein after the Birth ceaſing from the office of a Vein, and degenerating into a Ligament, though it might be accounted its root then, it cannot properly now. Others think, that becauſe its branches every where inſerted into the Inteſtines bring blood from thence to the Liver, (and not *vice verſa*) therefore thoſe ought rather to be accounted its roots, and its diviſions within the Liver its branches. And indeed ſtrictly and properly they ought to be accounted ſo, but however we ſhall not think it abſurd to ſpeak with the Ancients, who becauſe they thought the *Porta* carried blood from the Liver to the Guts for their nouriſhment, ſuppos'd it to ſpring out of the Liver.

As it enters into the Liver, it is inveſted with another Coat, which ſome call *Vagina portæ*, its Sheath, others *Capſula* or *involucrum* its Caſe, or *Cover*, and *Capſula communis*, becauſe the *Porus bilarius* is involved in it as well as the *Porta.* This outer Coat it has immediately from the membrane that cloaths the Liver, that is, it is continued from it, though it be of a clear other ſubſtance, namely more denſe and carnous. It is inveſted with it in all its ramifications, and ſo having a double Coat is in that reſpect an Artery, as alſo in that it brings blood to the Liver for its nouriſhment as well as for other uſes, and laſtly, in that by means of the *Arteria hepatica* inſerted into the *Capſula* it has an obſcure pulſation (according to Doctor *Gliſſon.)*

Branchings in the Liver. *Its* Sinus.

When it is enter'd about half an inch into the Liver, it is carried partly to the right hand, partly to the left, and ſo is ſhap'd into a *Sinus* as it were, and thence is divided into five large branches, four whereof are diffus'd all over the hollow ſide of the Liver, but the fifth aſcends ſtreight to its upper ſide where it diſperſes it ſelf. The ſaid *Sinus* is more conſpicuous in an *Embryo*, becauſe the great influx of nutritious juice by the Umbilical Vein enlarges it much. Some make it a ſort of Heart, obſerving in it an obſcurer kind of *Syſtole* and *Diaſtole*, whereby the motion of the blood in the branches of the *Porta* within the Liver, is promoted in like manner as it is in the *Arteria pulmonaris* and *Aorta* by the right and left Ventricles of the heart. Without which pulſation they think the blood would hardly paſs out of the larger branches of the *Porta* into the narrower, and ſo on into the roots of the *Cava*. In an *Embryo* very obſervable is the *Tubulus* or *Canalis venoſus*, which paſſes directly out of this *Sinus* into the *Cava*, (almoſt oppoſite to the mouth of the Umbilical Vein that opens into the *Sinus.*) This *Canalis* or Pipe is of the ſame ſubſtance and texture with a Vein, and enters into the *Cava* juſt as it penetrates the Diaphragm; and there alſo two other great branches out of the Liver are inſerted into the *Cava*; and in the ſame place this Pipe is alſo knit to the ſuſpenſory Ligament ſpoken of before, and after the Child is born grows it ſelf into a Ligament, being in a manner oppoſite to the umbilical Ligament. Its *Uſe* in the *fœtus* is for the freer and readier motion of the blood and chyle out of the umbilical Vein into the *Cava*, ſeeing the current is hardly ſtrong enough to pervade the *Parenchyma* of the Liver; nor indeed is there any reaſon why the ſaid liquors ſhould paſs there-through, ſeeing there is either little or no Bile therein; or however they are not yet in a condition to have the ſame ſeparated from them. But to return to the diviſions of the *Porta*. The Ancients taught that they were only ſpread in the ſimous or hollow part of the Liver, but Dr. *Gliſſon* in his accurate Anatomy of it, affirms the *Porta* to be diſperſed very equally in all its parts, upper as well as lower. And whereas it has been a conſtant doctrine, that the branches of the *Porta* open by *anaſtomoſes* into thoſe of the *Cava*, the ſame learned Authour, and many others ſince him, have obſerved, that there are no ſuch *anaſtomoſes* at all, but that the blood doth ouze through the glandulous *Parenchyma* of the Liver out of the Capillary veins of the *Porta* into thoſe of the *Cava*. He that would be fullier informed hereof, may conſult his moſt accurate Book *de Hepate*. But we will now paſs to the branches of the *Porta* when it is gone out of the Liver.

Its branches without the Liver.

This Trunk having paſt a little from the Liver, before it be ſevered into branches, puts forth two twigs, out of its upper and fore-part, which are inſerted into the *Cyſtis fellea* or Gall-bladder (and are from thence called *Cyſticæ gemellæ*) about the neck of it, and ſpread by innumerable twigs through its external coat.

A third twig alſo ariſes ſingle from it, which is larger than either of the former, and is inſerted into the bottom of the right ſide of the Stomach, from whence it aſcends by its hinder ſide up to the *Pylorus*, which gives it the name of *Pylorica*; it is otherwiſe called *Gaſtrica dextra*.

Having ſent forth theſe three twigs, the Trunk paſſeth down, and bending a little towards the left ſide, it is parted into two remarkable branches; whereof the upper is called *ſiniſter*, or the *left*, and is the leſſer: the lower *dexter*, or the *right*, which is the larger. The *left* is beſtowed upon the Stomach, the *Omentum*, a part of *Colon*, and the Spleen; the *right* is ſpread through the Guts and Meſentery: the left is called *Vena ſplenica*; but the right *Vena meſenterica*.

Vena ſplenica.

The *Vena ſplenica* runs acroſs the body towards the left ſide, being ſuſtained by the hinder leaf of the Caul, and hath two branches iſſuing out of it before it come to the Spleen, *viz.* the *ſuperiour* and the *inferiour*.

The *ſuperiour* is called *Gaſtrica*, or *Ventricularis*, becauſe it is beſtowed upon the Stomach. It aſcends obliquely towards the left part of the Stomach, into the back ſide whereof it is inſerted, and divides it ſelf into three ſprigs, of which the two outmoſt are ſpent on the body of the Stomach, but the middle aſcends on its back-ſide up to its upper or left orifice, which it encompaſſes like a Garland, and is called *Coronaria*. From the *inferiour* branch two twigs ſpring; The one is ſmall, and ſends twigs to the right ſide of the inner leaf of the *Omentum*, and to the *Colon* annexed to it.

This is called *Epiploïs* or *Omentalis dextra.* The other is ſpent upon the ſame leaf of the *Omentum*, with that part of the *Colon* which it ties to the Back, and is called *Epiploïs* or *Omentalis poſtica.*

When the *Ramus ſplenicus* hath juſt approached to the Spleen, it ſends out two other twigs, the upper and lower. The *upper* is called *vas breve venoſum*, and is implanted into the left part of the bottom of the Stomach. It is ſometimes ſingle, in which caſe it is properly called *vas breve* in the ſingular number; but more often there are two, three or more of them, and then they ſhould be called *vaſa brevia.* And note that theſe Veſſels, be they one or more, do ſometimes ſpring from the *Ramus ſplenicus* after it has entered the Spleen.

This *vas breve* was a veſſel much renowned by the Ancients, who believed it carried an acid juice from the Spleen to the Stomach to ſtir up appetite and to help the fermentation of the meat in it; but it is certain both by Ligature (whereby it filleth toward the Stomach, and emptieth toward the Spleen) and alſo by the general nature of Veins, whoſe ſmaller branches and twigs ſtill receive the ſuperfluous Arterial blood from the part whereinto they are inſerted, and conduct it by the larger chanels towards the Heart; I ſay it is certain from hence, that this ſame *vas breve* carries nothing to the Stomach, but onely brings from thence into the *Ramus ſplenicus* the remains of the arterial blood.

From the *lower*, two Twigs iſſue.

The firſt is called *Gaſtroëpiploïs ſiniſtra*; this is beſtowed upon the left part of the bottom of the Stomach, and the fore leaf of the *Omentum*, chiefly on its left part.

The ſecond ſpringeth moſt commonly indeed from *Ramus ſplenicus*, but ſometimes from the left Meſenterick vein; and running along the *Inteſtinum Rectum*, is inſerted into the *Anus*, by many twigs. This is called *Hæmorrhoïdalis interna*, as that which ſpringeth from the *Vena cava* is called *Hæmorrhoïdalis externa*.

Now followeth *Vena meſenterica*, or the *right* branch of *Vena portæ*. Before it be divided into branches, it ſendeth forth two twigs.

Vena meſenterica.

The firſt is called *Gaſtroëpiplois dextra*; this is beſtowed upon the right part of the bottom of the Stomach, and the right ſide of the upper leaf of the Caul.

The ſecond is called *Inteſtinalis*, or *Duodena*: It is inſerted into the middle of the *Duodenum*, and the beginning of the *Jejunum*, and runneth lengthways of them: whence ſome capillary twigs go to the *Pancreas* and the upper part of the *Omentum*.

After theſe twigs are paſt from it, it enters by one trunk into the Meſentery, where preſently it is divided into two branches, to wit, *Meſenterica dextra, & ſiniſtra.*

Meſenterica dextra (placed on the right ſide) is double, and ſendeth a great number of branches to the *Jejunum*, *Ileum*, *Cæcum*, and the right part of the *Colon* which aſcendeth up by the right Kidney and runs under the Liver.

It hath fourteen remarkable, though nameleſs branches; and theſe are afterwards divided into innumerable ſmall twigs. Theſe are thoſe Veins that are called the Meſaraicks, whoſe branches are ſupported by the Glandules of the Meſentery, but enter not into them; for the Glands miniſter to the *venæ lacteæ*.

Meſenterica ſiniſtra paſſeth through the middle of the Meſentery, to that part of the *Colon* which deſcendeth from the left part of the Stomach, and to the *Inteſtinum Rectum.*

The Uſe of the Porta. The *Uſe* of the *Porta*, before the circulation of the blood, and the *Venæ lacteæ* were found out, was taught to be for the carrying of nouriſhment to the Inteſtines and other parts contained in the *Abdomen*, and alſo to bring back from the Guts the purer part of the Chyle to the Liver to make Blood of, and a thicker feculent part of it to the Spleen, to be excocted by it into an acid juice, and then carried to the Stomach by the *vas breve venoſum* for the exciting of hunger. As for this laſt opinion, it appears by Ligature, that the *vas breve* carries its contents from the Stomach to the *Ramus ſplenicus*, and it is nothing but the Blood remaining from the nutrition of the Stomach (that was brought thither by the Arteries) which is now a conveying back to the Liver and ſo to the Heart again in its circulation. And as for the Meſaraicks carrying nouriſhment to the Guts, or bringing back Chyle, thoſe errours have been ſufficiently laid open before in the Chapters of the *Venæ lacteæ* and the Liver. And their true *Uſe* is only to bring back to the Liver from the Guts that Blood which remains after their nutrition, and which was carried to them by the meſaraick Arteries.

CHAP.

CHAP. XIII.

Of the Vena Cava *diſperſed within the* Abdomen.

Vena cava. *Its name.*

THE *Vena Cava* is ſo called from its large Cavity, being the moſt capacious of any Vein of the whole Body; for into it as into a River or common Chanel do all the other Veins like Rivulets (excepting the *Pulmonaria*) empty themſelves.

Riſe.

Its *Root* may very properly be ſaid to be in the Liver; for by its Capillaries it receives the Blood that is tranſcolated through the glandulous *parenchyma* of the Liver from the Capillaries of the *Porta*, and by its aſcending trunk conveys it to the Heart. Now theſe roots may in ſome regard be commodiouſly enough alſo called branches; for the roots of a Tree in the Earth, as well as its boughs in the Air are ſpread into many branches: onely there is this difference, that roots bring ſap to the trunk, but boughs carry it from the ſame. However we ſhall call them indifferently roots or branches. The capillary branches then of the *Cava* are ſpread through the whole ſubſtance of the Liver, and not its upper or gibbous part onely, as has formerly been taught; even as we ſaid before that the Capillaries of the *Porta* were indifferently diſpers'd all over it. Betwixt theſe Capillaries (much leſs betwixt their larger branches) there are no inoſculations or anaſtomoſes, but thoſe of the *Porta* being quite obliterated in the glands or glandulous *Parenchyma* of the Liver, theſe of the *Cava* ariſe out of the ſame, and whiles they paſs towards the trunk of the *Cava*, many of them meeting together make a twig, as many twigs in like manner concurring make a branch, which ſtill proceeding further, by the acceſſion of new twigs and branches becomes larger aud larger, and at length diſchargeth it ſelf into the *Cava*. And thus do all the roots of the *Cava* in the Liver. But they do not all meet together in one common trunk within the Liver, as thoſe of the *Porta* do, but empty themſelves apart into the *Cava* without the Liver. And ſtill the further diſtance the Capillaries have their origine from the *Cava*, the larger their chanel comes to be at their arrival at it. The ſmaller twigs are innumerable; the larger roots joyning immediately to the *Cava* are commonly but three, though two of them are preſently (towards the Liver) divided into other two, as large each as themſelves, ſo that one may account them to be five.

Diviſion. Theſe emptying all the Blood exhauſted out of the Liver into the *Cava*, it is preſently *divided* into the Aſcending and Deſcending trunk. The *Aſcending* forthwith enters the Diaphragm and marches up the *Thorax*, where we ſhall leave it till we come thither, and onely here ſpeak of the *Deſcending* trunk as long as it continues in the *Abdomen*.

Its deſcending trunk. The *Deſcending* trunk is ſomewhat narrower than the *Aſcending*, and paſſing down along with the great Artery it continues undivided till the fourth *vertebra* of the Loins. But in the mean time it ſends forth divers branches from its trunk. As

1. The *Venæ adipoſæ*, for the Coat and fat of the Kidneys; whereof that on the left ſide goes out firſt. 2.

2. The *Emulgents*, which run to the Kidneys by a ſhort and oblique paſſage; theſe bring back that blood to the *Cava* which the emulgent Arteries carried to the Kidneys with the *Serum*.

3. The *Spermaticks*, called *Vaſa præparantia*. The right ſpringeth from the trunk of *Vena Cava* a little below the *Emulgent*; but the left from the left *Emulgent* it ſelf. Of theſe more in the 20*th* Chapter.

4. The *Lumbares*, ſometimes two, ſometimes three. Theſe run in between four *vertebræ* of the Loins, and are diſperſed through the membranes that cloath the ſpinal marrow.

All theſe Veins being ſent forth of the trunk, by this time it is come to the fourth *vertebra* of the Loins, where it turns to behind the *Arteria magna*, above or before which it had thus far deſcended, and is divided into two equal branches, called *Iliaci*, becauſe they paſs over the *Os ileon*, &c. as they go down to the Thighs.

Juſt about the diviſion there ſpring two Veins called, *Muſcula ſuperior*, for the *Peritonæum* and Muſcles of the Loins and *Abdomen*; and *Sacra*, which is ſometimes ſingle, ſometimes double, for the marrow of *Os ſacrum*, or rather for the membranes that cloath it.

Afterwards the *Iliacal* branches are again divided each into two other; the Exteriour that is greater, and the Interiour that is leſs.

From the *interiour* ariſe two Veins: *Muſcula media*, for the Muſcles of the Hip and Buttocks; and *Hypogaſtrica*, which is a notable one, ſometimes double, miniſtring to moſt parts of the *Hypogaſtrium*; as, to the Muſcles of the ſtreight Gut, (which branches make the external Hæmorrhoidals;) to the Bladder and its neck, to the Yard, and the lower ſide of the Womb and its neck, which laſt are the Veins by which the Menſtrues were believed to paſs, before the circulation of the Blood was found out; for ſince 'tis known that they paſs by the Hypogaſtrick Arteries, and what Blood is not ſent forth at thoſe times, or at other times is not ſpent on the nutrition of theſe parts, returns by theſe Veins to the *Cava*, and by it to the Heart.

From the *exteriour*, three: two before it goes out of the *Peritonæum*, and one after.

1. *Epigaſtrica*, for the *Peritonæum* and the Muſcles of the *Abdomen*; the moſt noted branch of it aſcends under the *Muſculi recti* towards the *Vena mammaria*, with which it has been thought to inoſculate about the Navel.

2. *Pudenda*, for the Genitals in Men and Women.

3. *Muſcula inferior*, for the Buttocks.

And now the deſcending branches of the *Cava* are paſt out of the *Abdomen* into the Thighs, and begin to be called Crural; and of them we ſhall diſcourſe when we come to the *Limbs*, in *Book* IV. *Chap*. 4.

Its Uſe. Now the *Uſe* of this Deſcending trunk of the *Vena Cava* is not to carry any thing to any part from the Liver; but whereſoever its leſſer twigs end into Capillaries, from thence is Blood received (being brought thither by the reſpective Arteries) and conveyed into the greater branches, and by them into the trunk of the *Cava*, by which it aſcends to the right ventricle of the Heart, there to be anew inſpirited, and from thence to be ſent forth again by the Arteries, as ſhall be further explained when we come to the Heart.

For though the Deſcending trunk of the *Aorta* or great Artery paſs down the *Abdomen* along with that of the *Cava*, and ſo is contained therein as well as it; yet becauſe the Arteries have all of them their Origine from the Heart, we will forbear to ſpeak of *them* till we come to the Anatomy of *it*, in the next Book.

CHAP. XIV.

Of the Gall-bladder and Porus bilarius.

FOR the receiving and evacuating of Bile there have been reckoned only two Veſſels or paſſages, namely the *Gall-bladder*, and *Porus bilarius.* By this latter there flows a thicker but milder, by the former a thinner, more acrimonious and fermentative Choler into the Inteſtines. But beſides theſe there hath lately been found out a third, which we ſhall deſcribe by and by.

The Gall-bladder. Its Name and Deſcription.

The *Gall-bladder*, called in Greek κύστις χοληδόχος, in Latine *Veſica bilaria*, or *Folliculus fellis*, is a hollow Bag placed in the under or hollow ſide of the Liver, and in figure repreſenteth a Pear.

Bigneſs.

It is about two inches in length, and one in breadth where broadeſt.

Connexion.

By its upper part it adheres to the Liver, which doth afford it a hollowneſs to lodge in; but the lower part which hangeth without the Liver, reſteth upon the right ſide of the Stomach, and the *Colon*, and doth often dye them both yellow.

Membranes.

It hath three *Membranes*, one *common*, which is thin and outmoſt. This ſpringing from the Membrane of the Liver, onely covereth that part which hangeth without the Liver. The two other Membranes are *proper*.

The middle is thick and ſtrong, and hath three ranks of *Fibres*; the outermoſt are tranſverſe, the middlemoſt oblique, and the innermoſt ſtreight.

The inmoſt Coat is nervous, or tendinous as it were; and to the inſide of this there adhereth a kind of glandulous coat. The Glands herein do ſeparate from the Arteries a kind of mucous humour, which ſerves to defend the *Veſica* from being irritated by the acrimony of the Choler contained in it.

Parts. It hath two *Parts*, the *Bottom* and the *Neck*.

The *Bottom* is its larger or wider part that contains the Choler, and is of the ſame colour with the bile that is in it; whence it commonly looks yellow, but ſometimes greeniſh, blackiſh, &c.

The *Neck* (otherwiſe called *meatus cyſticus*) is its narrower part, being but about as wide as a Gooſe-quill, and about two inches long. Betwixt this and the *Veſica* there is a certain fibrous Ring which much ſtraitens the paſſage, and ſo hinders the too haſty depletion of the *Veſica*. The other end of the Neck is joined to the *Porus bilarius*, and they both make the *Ductus communis*, or common paſſage of the Choler, which is inſerted into the beginning of the *Jejunum*, or the end of the *Duodenum*. *Peierus* has obſerved that in many Birds and ſome Fiſhes this *Meatus* does not join the *Porus bilarius*, but is inſerted ſeparately into the Guts.

How the Choler is brought into it. The Ancients (whoſe opinion is of late ſtifly defended by Dr. *Cole) thought that the Choler in the Gall-bladder was received in by its neck from the *Porus bilarius*, and that it paſſed out into the common Duct the ſame way. And to obviate the Objection, that there uſes not to be a reciprocation of humours in the ſame Veſſel, (at the ſame time eſpecially) Dr. *Cole* ſuppoſes that the Gall paſſes out of the Gall-bladder onely in the time of the diſtribution of the Chyle, but at all other times it is received into it from the *Porus*, and is ſtored up in it againſt the next occaſion. But not to enter into this diſpute, I think Dr. *Gliſſon*'s account of it the more probable, which is this: "The ordinary way of filling the Gall-"bladder, is by its fibrous roots that are diſper-"ſed through the Liver. The whole trunk of "theſe roots enters that part of the Bladder "where 'tis ſtraitned by a fibrous Ring. This "trunk indeed hardly equals the hundredth part "of the roots of the *Porus bilarius*; yet it di-"ſtributes ſome twigs and capillary Veſſels into "the hollow ſide of the Liver. But if you open "the Gall-bladder with a deſign to underſtand "the manner of the inſertion of this trunk into "it, truly you will not eaſily find it. For "though this Duct do penetrate the ſaid Blad-"der, and the humour contain'd in it be diſ-"charged thereinto; yet there is hardly any "print or ſign of this hole in the inſide of the "Bladder; which ought not to ſeem hard to be "believed by any one, if he remember the inſer-"tion of the Ureters into the Piſs-bladder: for "though theſe do far exceed this trunk in width, "yet one can hardly find their inſertion if he "cut open the Bladder and look for it. The beſt "way (that I could yet find) to diſcover the in-"ſertion of this trunk, (if you will open the

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* De ſecret. Animal. *Cap.* 14.

Anat. Hepat.

“ Gall-bladder, and ſearch for its entrance into “ it) is thus: namely, if you look for a certain “ little and ſpungy protuberance near the orifice “ of the Bladder hard by the *meatus cyſticus*; for “ the foreſaid trunk, I think, is pretty plainly “ inſerted into that protuberance.] This protuberance is called a Valve by *Spigelius*.

Ductus cyſt-hepaticus.

Beſides this, Mr. *Perrault* has found out another *new Conduit* for the Bile, which he calls *ductus cyſt-hepaticus*, becauſe it is common both to the *Veſicula* and the *Porus hepaticus* (or *bilarius*.) This Duct has three roots, which being ſubdivided into numerous twigs are diſperſed through the Parenchyma of the Liver amongſt the branches of the *Vena cava* and *Portæ*: Theſe roots grow into one trunk, which creeping along the ſur~~face of the~~ hollow ſide of the Liver, has a double implantation, one into the *Porus bilarius* two inches and an half before the ſaid *Porus*’s uniting with the *Meatus cyſticus*, and another into the middle of the *Veſica* (on that ſide of it which adheres to the Liver) with a Valve. This Valve ſeems to be formed of the inner Membrane of the *Veſica*, and alſo a proper one; and may be ſaid to be a kind of a middle Valve between the nature of the *Sigmoides* and *Triglottis* (or *Tricuſpis*) of the *Vena arterioſa* and *Arteria venoſa* in the Heart. Betwixt its inſertion into the *Porus bilarius*, and this into the *Veſica*, there is about ſix inches length. It contains a thinner Choler in it, than the *Porus bilarius*.

Of the circulation of the Bile.

Jo. Alph. Borellus (Profeſſor of the Mathematicks at *Naples*) from the continual and ſpeedy efflux of the Bile by the *Ductus communis* into the *Duodenum*, believes that there is a particular circulation of it. For he affirms, That in a days time, from a perſon faſting, there paſs thirty four pound of bilious juice into the *Duodenum* by the common *Duct*, whereas the whole maſs of Gall amounts not to above two pound; from whence *as* he concludes, that ſo great a quantity of Gall cannot be produced in the Liver by way of fermentation, but that it is ſeparated mechanically, without the help of any ferment, only by *Cribration* from the minute veſſels of the *Porta* through the Pores of the Glandules of the Liver, as the Urine is ſeparated in the Kidneys; *ſo* he infers that there is a particular circulation of the *Bilis* through the *Abdomen*, perform'd by the *Venæ meſaraicæ* into the Trunk of the *Porta*, thence to the Liver, thence through the Bilious veſſels into the *Duodenum*, to return again by the Meſaraick veins. He that would enquire more into this novel, and (to me) improbable Opinion, may conſult his *Opus poſthumum* (pars altera) *de motu Animalium.*

The Valves of the Gall-bladder.

It has been taught by ſeveral Anatomiſts, that its Neck or *Meatus* has ſometimes two, ſometimes three *Valves* to hinder the recourſe of the Choler: but *Diemerbroeck* profeſſes he could never find any, but only that the egreſs of the *Veſica* was very ſtrait, and its Neck wrinkled. Dr. *Gliſſon* declares alſo that he has opened very many Veſſels of this kind, and never yet ſaw a *Valve* in any of them. But he thinks that the fibrous ring (above mention'd) did impoſe upon thoſe who have thought there was a *Valve*. Beſides, upon tryal he has often found, that the Bile by a light compreſſion of the Fingers, has fluctuated to and again out of the *Cyſtis* into the *Meatus*, and on the contrary; as alſo out of the *Meatus* into the *Ductus communis*, and back again. Which certainly could not be, if there were any *valve* in the way; for that would hinder the one or other of theſe motions.

Its Veſſels. The *Veſica fellea* hath two *Veins* called *Cyſticæ gemellæ*, which ſpring from the *Porta*. It hath twigs of *Arteries* proceeding from the right branch of the *Cœliaca*. And it hath a ſmall thread-like ſprig of a *Nerve* from the Meſenterical branch of the Intercoſtal.

Of the ſtones in it. Many times *Stones* are found in it, which are lighter and more ſpongy than thoſe of the urinary Bladder, and will ſwim above water, which theſe latter will not do.

Porus bilarius. The other paſſage which carrieth the thicker ſort of Choler, is called *Porus bilarius*, or *Meatus hepaticus*, becauſe it paſſeth directly from the Liver to the *Ductus communis*.

Its Coats, and branchings within the Liver. Within the Liver its Trunk and Branches are inveſted with a double Coat: its *proper* one, which it retains without the Liver alſo, and another that is *common* to it with the *Porta* called *Capſula communis*, which it has from the Membrane of the Liver. In this *common* Coat this *Porus* and the *Porta* are ſo cloſely enwrapped, that you would take them but for one Veſſel, till you either hold it up to the light, (which will diſcover Veſſels of two colours in it) or very dextrouſly rip up the *Capſula*, and ſo lay them open. Its roots within the Liver are equally divided with thoſe of the *Porta* every where, ſaving that little ſpace where the roots of the *Veſica* are ſpread, in the ſimous and right ſide of the Liver. So that having ſpoken above of the diviſions of the roots of the *Porta*, I ſhall refer the Reader thither for theſe of the *Porus*. I ſhall only obſerve, that they are far larger and more numerous than thoſe of the *Veſica*, drawing Choler from all the parts of the Liver, (ſaving whither the roots of the Bladder reach) and that more thick and viſcous, yet leſs acrimonious.

This P*orus* ſeems to be a more neceſſary part than the *Veſica*; for many Creatures, as Harts, Fallow-Deer, the Sea-Calf, *&c.* and thoſe which have a whole Hoof, as an Horſe, *&c.* have no Gall-bladder, but there is none that is deſtitute of this.

All Animals have it.

Without the Liver it is as wide again as the *Meatus cyſticus*, with which it is joyned at two Inches diſtance from the Liver, and both make the *Ductus communis choledochus*.

Its connexion with the Meatus.

It has no *Valve* in its whole progreſs; only the *Ductus communis*, where it enters the Inteſtin, having pierced the outer Coat, paſſes betwixt that and the middlemoſt about the twelfth part of an Inch, and then piercing that alſo marches down further betwixt it and the innermoſt Coat about half an Inch, and at laſt opens with a round mouth into the Inteſtin. So that this oblique Inſertion (as that of the Ureter into the urinary Bladder) ſerves inſtead of a *Valve* to hinder any thing from regurgitating out of the Gut into this Duct, eſpecially the inmoſt Tunicle of the Inteſtin hanging ſo flaggy before its mouth, that when any thing would enter in, it claps cloſe upon it and ſtops it.

It hath no Valve.

As to any *Anaſtomoſes* of the roots of any of theſe Bilary veſſels, with thoſe of the *Vena* P*ortæ*, ſuch indeed have been much talk'd of, but without truth, for their extream Twigs or Capillaries terminate in the P*arenchyma* of the Liver, out of whoſe Grape-ſtone-like Glandules they imbibe the Choler there ſeparated from the Blood; even as

nor Anaſtomoſes with the Porta.

as was ſaid before of the Capillaries of the *Cava*, that they received the Blood it ſelf imported by the *Porta*, in like manner, without any inoſculations.

The uſe of the Veſica, ductus cyſt-h pa-ticus,e *and* porus.

The *Uſe* of all theſe *Veſſels* may ſufficiently be learned by what has already been ſaid of them. Though ſome are of opinion, that not only Choler, but other ſuperfluous humours are evacuated by them, eſpecially upon taking a Purge.

The *uſe* of the *Bile* it ſelf appears from what we quoted above out of *Diemerbroeck*, when we were treating of the action of the Liver, *cap.* 12. We will only further note two things.

Obſerv. 1.

Firſt, That ſometimes the *Ductus communis* is very irregularly *inſerted.* For in ſome it is knit to the bottom of the Stomach, and then the party vomiteth Choler, and is termed πικρόχολος ἄνω· and ſometimes it is inſerted into the lower end of the *Jejunum*, and then bilious dejections follow; and ſuch a one is termed πικρόχολος κάτω.

Obſerv. 2.

A *ſecond* thing is concerning the *colour* of the Bile; that though for the moſt part, in a healthful ſtate, it be yellow, yet preternaturally and in a morbous ſtate it is often of ſeveral other colours, as pale-coloured, eruginous, porraceous, vitelline, reddiſh and blackiſh. And when it thus degenerates and corrupts, it is the cauſe of moſt violent and acute Diſeaſes; as the *Cholera morbus*, Dyſentery, Colick, *&c.*

CHAP.

CHAP. XV.

Of the Pancreas.

THE P*ancreas* (as much as to ſay, *All-fleſh*) or the *Sweet-bread*, except its Membranes and Veſſels, is wholly Glandulous. It ſeems to be compacted out of many Globules or knots included in a common Membrane, and joyn'd one to another partly by Membranes, and partly by Veſſels. Every Globule by it ſelf is ſomewhat hard ; but all together (becauſe of their looſe connexion) ſeem ſoftiſh. It is of a paliſh colour, very little tinctured with red. Its inveſting Membrane it has from the P*eritonæum*. *The* Pancreas. *Its Subſtance.*

It is *ſeated* under the bottom and towards the hinder ſide of the Stomach, and reaches from the Cavity of the Liver, (namely from that part where the P*orta* enters it) to the lower end of the Spleen, croſs the *Abdomen*. It is annexed (by its *Duct*) to the *Duodenum*, and ſometimes to the *Ductus bilarius*, to the *Rami ſplenici*, the Caul, the upper part of the Meſentery, and upper *Nervous plexus* of the *Abdomen*. It is not joyned to the Spleen. *Situation, and connexion.*

Its *figure* is long and flat, broader and thicker about the *Duodenum*, but towards the Spleen thinner and ſtraiter. *Figure.*

It is leſſer than moſt of the *Viſcera*, commonly about five Fingers breadth long : where it is broadeſt, it is about two Fingers breadth, and about one Fingers breadth thick. *Bigneſs.*

Its *Veſſels* are of five kinds. *Veins* it has from the ſplenick branch ; *Arteries* from the left branch *Veſſels.*

of the *Cœliaca*, ſometimes from the Splenick; *Nerves* from the Intercoſtal pair, eſpecially from the upper *plexus* of the *Abdomen*; it has alſo many *Vaſa lymphatica*, which, as the reſt, paſs to the *Receptaculm chyli.*

Ductus pancreaticus.

But beſides theſe Veſſels which are common to it with other parts, it has a proper membranous Duct of its own, which was firſt found out by *Wirtſungus* at *Padua* above forty years ago. This Veſſel commonly has but one Trunk, whoſe Orifice opens into the lower end of the *Duodenum* or beginning of the *Jejunum*, and ſometimes is joyned to the *Ductus bilarius*, with which it makes but one mouth into the Inteſtin. Within the *Pancreas* (according to Dr. *Wharton*) it is divided into two Branches, which ſend forth abundance of little Twigs into all the *Globuli* above ſpoken of, where they imbibe the Humour that is ſeparated by them from the Arteries, and by their Trunk tranſmit it to the Guts. This Pancreatick humour tho' is never found in this Duct, becauſe it flows ſo quickly out of it into the *Duodenum* by a ſteep way; even juſt as the Urine, paſſing out of the Reins by the Ureters to the Bladder, is never found in them becauſe of its rapid tranſit.

Office.

Very many have been the differences of Opinions concerning the *office* of this Glandule. Some have thought it to be only of uſe to ſuſtain the diviſions of the Veſſels, and to ſerve the Stomach for a Cuſhion to reſt upon; others, that it miniſters a ferment to the Stomach; others, that it receives the Chyle, and brings it to greater perfection: and others, that it ſerves as a Gall-bladder to the Spleen, or ſometimes ſerves in its ſtead. Which Opinions being all very unlikely, ly, I ſhall not ſpend time to examine them.

The nature of the pancreatick juice.

There are three other Opinions, for the *firſt* whereof let the credit of the learned Author (*viz.* Dr. *Wharton*) recommend it as it can, but to me it ſeems improbable, and it is this, That it receives the Excrements or Superfluities of the ſuperiour *plexus* of the Nerves of the ſixth pair, (Dr *Willis*'s Intercoſtal or ninth pair) being united with ſome branches from the ſpinal marrow, and by its proper Veſſel or Duct diſcharges them into the Inteſtins. In anſwer unto which I ſhall only ſay this, That I cannot tell how thick Excrements ſhould be convey'd by the Nerves that carry ſuch pure Animal Spirits, and have no viſible Cavity; nor ſecondly, how theſe Nerves in particular ſhould *cum delectu* (as he ſpeaks) ſend the Excrements hither, and all the reſt be diſcharged from any ſuch Office.

The *ſecond* Opinion is ſomewhat more probable, and is defended by famous Phyſicians and Anatomiſts, as *Franc. Sylvius*, *Bern. Swalve*, *Regn. de Graef*, and *Isbrand de Diemerbroeck*, from which laſt I ſhall tranſcribe it. "I have found, *ſaith he*, "in the Diſſections of Brutes both alive, and "newly ſtrangled, a certain liquor ſublimpid, "and as it were ſalivous, (ſomething auſtere "and lightly ſubacid, and having ſometimes "ſomething of ſaltiſhneſs mixed) to flow out of "the *Ductus pancreaticus* into the *Duodenum*, "ſometimes in a pretty quantity. Whence I "judged---that there is excocted in the P*ancreas* "a peculiar humour from the ſerous and ſaltiſh "part of the Arterial blood brought into it, ha"ving ſome few Animal Spirits convey'd thither "by ſmall Nerves mixed with it, and that this "liquor flowing into the *Duodenum*, and there

" preſently mixed with the Bile, and the Meat " concocted in the Stomach gliding by the *Pylorus* into the Guts, does cauſe a peculiar effervеſcency in thoſe Aliments, whereby the " profitable chylous particles are ſeparated from " the unprofitable, are attenuated, and being " brought to greater fuſion (This Operation of " it, *ſays he*, is ſhewn by the diverſity of the ſubſtance of the Aliments, concocted in the Stomach, and ſtill there contained, from that of " thoſe which have already flow'd into the Inteſtins: for the former are viſcid and thick, " and have the various colours of the food taken: " but the latter on the contrary are more fluid, " leſs viſcid, and more white) are withal made " apt to be impelled by the periſtaltick motion " of the Guts, through their inner mucous Coat " into the Lacteal veſſels, the other thicker by " little and little paſſing down to the thick Guts, " to be there kept till the time of excretion. Now " this effervеſcency is cauſed through the volatile Salt and ſulphureous Oyl of the Bile meeting with the acidity of the Pancreatick juice; " as in Chymiſtry we obſerve the like Effervеſcencies to be cauſed by the concourſe of ſuch " things.] Thus he. So that he will not have this Juice to be any thing excrementitious, nor to be ſo very little in quantity, as ſome have affirmed; to demonſtrate which he cites the Experiment of *de Graef*, who in Live-diſſections could gather ſometimes an Ounce of it in ſeven or eight hours time, which he has taſted, and found it of the taſte before-mentioned, *viz.* ſomething auſtere, ſubacid and ſaltiſh. *Vide ejus Anatomen corporis humani*, p. 73, *&c.* where you may ſee what Diſeaſes it is the cauſe of when diſtempered.

A *third* Opinion is that of *Brunnerus*, who thinks that the *Pancreas* is of the ſame uſe with the other conglomerate Glands of the Mouth, Throat, Stomach, and Guts, and its Juice of the ſame nature with the *Saliva*. That it conſiſts of *Lympha* ſeparated from the Arteries, and of Animal or Nitro-aereal Spirits communicated by the Nerves. That like the *Saliva* it is a Diſſolvent or *Menſtruum* in concoction and chylification, but does not ferment with the Bile, but only takes ſomewhat off its Acrimony. That its juice is not of any *peculiar* ſort, he endeavours to evince by repeated Experiments upon Dogs, from ſome of whom he cut the greateſt part of the *Pancreas*, and in others cut aſunder its Duct that paſſes from it to the Inteſtins, and yet they continued (after two or three days indiſpoſition) to be as lively, and in every reſpect in the ſame condition as before. From whence he concludes, that that juice which naturally flows out of the *Pancreas*, muſt in theſe caſes be ſupplied from other parts; and therefore that it is of no *peculiar* nature, but of the ſame with that of thoſe parts that ſupply its defect, and thoſe can be no other than the conglomerate Glands of the parts aforeſaid. He that would be further ſatisfied in the grounds of this Opinion, or how this ingenious Author made his Experiments, may conſult his Book lately publiſhed, entituled, *Experimenta nova circa* Pancreas, *&c.*

CHAP.

CHAP. XVI.

Of the Spleen.

The Spleen. Its name. THE *Spleen* is ſo called in *Engliſh*, from the *Greek* σπλὴν, from whence alſo the *Latin* word *Splen* is derived. It is otherwiſe called in Latin, *Lien*, and in Engliſh the *Milt*.

Number. It is commonly but one in Men, though ſome have found two, yea *Fallopius* three. In Dogs there are ſometimes two or three, unequal in bigneſs, out of each of which there paſſes a Veſſel into the *Ramus Splenicus*.

Colour. In Infants new-born it is of a red *Colour*: in thoſe of a ripe age it is ſomewhat blackiſh; and in old men it is of a leaden or livid colour.

Bigneſs. In Man it is broader, thicker, and heavier than in Beaſts; for it is about ſix Inches in length, three in breadth, and one in thickneſs. Sometimes it is much larger, but the bigger the worſe. *Spigelius* has obſerved, that it is larger in thoſe that live in fenny-places, than in thoſe that live in dry; and in thoſe that have large Veins, than in them that have ſmall.

Figure. As to its *figure*, *Hippocrates* compares it to an Oxe's Tongue; *Ariſtotle* to an Hog's Milt. Towards the Stomach on its inner-ſide it is ſomewhat hollow; on its outer, gibbous, having ſometimes ſome impreſſion upon it from the Ribs. It is ſmooth and equal on either ſide, ſave where in its hollow ſide it has a ſtreight line or ſeam (ῥαφὴ) at which place the Splenick-veſſels enter into it. Its upper end is called its *head*, and the lower its *tail*.

Situation.

It is *ſeated* in the left *Hypochondrium* oppoſite to the Liver: (ſo *Hippocrat. 6. Epidem.* calleth it the left Liver; and *Ariſtot.3. de hiſtor. animal.7.* the baſtard Liver) betwixt the Stomach and that end of the Ribs next the Back; in ſome higher, in others lower: but naturally it deſcends not below the loweſt Rib. Yet ſometimes its Ligaments are ſo relaxed, that it reaches down lower; yea ſometimes they quite break, ſo that it ſlips down into the *Hypogaſtrium:* ſo *Riolanus* tells the ſtory of a Woman that was troubled with a Tumour there, which was taken by her Phyſicians for a Mole; but dying of it, and being opened, it was found to be occaſioned by the Spleen fallen out of its place and lying upon the Womb.

Whether it may be cut out of the body with ſafety.

And whereas it very much endangers life when it falls out of its place, one would think that it could not but with great danger be cut out of the body. For how can one imagine that a part ſo difficult to come at, and that has ſuch large Veſſels inſerted into it, (not to mention its uſe) can with ſafety be taken out of the Body? Wounds in it are commonly mortal; Inflammation, or but Obſtructions in it do grievouſly afflict the Patient, and ſometimes kill him: ſure then the total ablation of it one would think ſhould be very fatal. And yet (among others) the ingenious *Brunnerus* in the Preface to his above-cited Book affirms, that he firſt took the Spleen from a Dog, and at ſome diſtance of time by a ſecond Operation cut out the greateſt part of the *Pancreas* from the ſame, and yet he continued to eat and drink, ſhit and piſs, and run about as briskly as if he had wanted neither of them, till about three Months after the laſt Operation he was loſt in a crowd. And *Malpighius* relates, how having

ving tyed all the Veſſels that come into or go out of the Spleen in a young Dog, (which is much the ſame thing as to cut it out) and cloſed up the wound in his ſide after the Operation, tho' hereby when the ſame ſide after a good while was open'd again, the Spleen was dried up almoſt to nothing; yet in the mean time the Dog was every way both as to his ſtomach, excrements, plight, briskneſs, &c. as well as before the Ligature. And *Ant. Nuck* tells us of a Dog out of whom he cut not only the Spleen, but one Kidney alſo, having firſt faſt tyed the Veſſels that go to and ſpring from each; and afterwards healing up the wound, the Dog continued in good plight.

Connexion. It is tyed to five parts; its upper part to the Midriff (commonly) and its lower to the left Kidney by thin Membranes; by its hollow part which giveth way to the Stomach being diſtended, to the upper Membrane of the *Omentum*, and to the Stomach by ſundry veſſels. Its gibbous or arched part is knit to the *Peritonæum* by thin Membranes.

Membranes. It is clothed with a double *Membrane*; the *outer*, common, being propagated from the *peritonæum*, (or as ſome will have it from the *Omentum*:) the *inner*, proper. The firſt is ſtrong, and contains the Spleen as in a bag: Both Veins, Arteries and Nerves run along it, and betwixt it and the inner a great number of Lympheducts. The Arteries that run through the inner Subſtance of the Spleen, do many of them terminate in it; ſo that when it is pulled off, (which 'tis not hard to do) you may diſcern a great many red ſpecks, which are the little mouths of the broken Arteries. The inner Membrane is ſmooth and ſtrong, but not ſo denſe but that Air can paſs through it, if one blow hard into the Spleen by the ſplenick Artery, after the outer Membrane is drawn off. Some think this Coat ſprings from the outer one of the Veſſels that enter the Spleen: *Malpighius* ſuppoſes it to be woven by an Implication of the Fibres that run overthwart the Spleen. Blood-veſſels run along this alſo, as one may obſerve by ſyringing Ink into the Splenick Artery; for then they are diſcover'd both by their ſwelling and alteration of colour.

Subſtance. The *ſubſtance* of it is flaggy, looſe, and ſpongy, commonly held to be a concrete ſanguineous body, ſerving to ſuſtain the veſſels that paſs through it: but *Malpighius* with his Microſcope has diſcover'd it to be (beſides the Fibres, to be deſcrib'd by and by) a *Congeries* of Membranes form'd and diſtinguiſh'd into Cells, in which are included very many Glands. Theſe Cells and Glands he deſcribes thus in the *fourth* and *fifth* Chapters of his *lib. de Liene.* "Though the Spleen by its colour and looſeneſs of ſubſtance ſeem to be fleſh, or concreted blood; yet if one tye the Artery, and blow hard by the Vein, (or on the contrary) the Spleen will exceedingly ſwell; and being thus blown up if it be dried, and afterwards cut, you may perceive its whole bulk to be made up of Membranes forming *Sinus*'s and Cells like Honeycombs. They are propagated either from the inveſting Membrane, or (which he thinks more probable) from the venous duct that runs along the middle of the Spleen; like as the Cells in the Lungs, he thinks, proceed from the Branches of the *Trachea* growing ſlender. Their ſhape is irregular; they communicate

" with one another, and gape not only into the " extream branches of the Splenick Duct, but al- " ſo into the ſides of the trunk it ſelf, by means " of the holes or pores therein (to be deſcribed " by and by.) They are watered with Blood- " veſſels, and within them are included nume- " rous bunches of Glands, or if you will, of " Bladders or little Bags, which do exactly re- " ſemble a bunch of Grapes. Theſe little Glands " have an oval figure, and are about as big as " thoſe of the Kidneys: I never ſaw them of " other colour than white; yea though the Blood- " veſſels of the Spleen be fill'd with Ink, and play " about them, yet they always keep the ſame co- " lour. Their ſubſtance looks as if it were mem- " branous, but 'tis ſoft and eaſily crumbled; their " Cavity is ſo ſmall that it cannot be ſeen, but " it may be gueſſed, in that when they are cut " they ſeem to fall into themſelves. They are al- " moſt innumerable, and are placed wonderfully " in the aforeſaid cells of the whole Spleen, where " vulgarly its *Parenchyma* is ſaid to be; and " they hang upon fibres ariſing from their caſe, " and conſequently on the utmoſt ends of the " Arteries and Nerves, yea the ends of the Arte- " ries twiſt about them like the Tendrils of " Vines, or clinging Ivy.——Each bunch conſiſts " of ſeven or eight.—Beſides the membranous " cells that encloſe them, they are covered with " a bloody ſubſtance, which plentifully ſtagnates " in thoſe cells; as appears by ſyringing water " by the Artery into the Spleen, for it will be " tinged after ſeveral repetitions, and bring a- " bundance of blood out with it.] Thus he.

Fibres. From the inner Membrane (according to *Malpighius*) ſpring innumerable *fibres*, which run acroſs the Spleen to the oppoſite part of the ſame Membrane, or to the *Capſula* or common caſe of the veſſels which runs through the middle of the Spleen. They keep not the ſame plane, but ever and anon being ſplit into two, they each inoſculate with others in like manner divided, and make a ſort of Net-work. The Ancients believed them to be twigs of blood-veſſels; Dr. *Gliſſon* ſuppoſes them alſo to be veſſels, but that they contain not blood, but nervous juice: But *Malpighius* concludes them to be only fibres, becauſe they have neither any diſcernible cavity, nor any communication with veſſels; and alſo becauſe both *Spigelius* and himſelf have obſerved the inner membrane of the Spleen, which affords riſe and inſertion to them, and is framed of a *plexus* of ſuch like fibres, to become bony and ſometimes cartilaginous, which he thinks cannot eaſily agree with the nature of veſſels. Their uſe he thinks to be only for the ſtrengthning and conſervation of the ſoft ſtructure of the Spleen.

Veſſels. *1. Veins.* It hath *Veſſels* of all kinds; as 1. *Veins* from the *Ramus ſplenicus* of the *Vena portæ*. The *Ramus* before it enter the Spleen has two Coats, but in its entrance its outer and thicker is received by the inner Coat of the Spleen, which (according to *Malpighius*) turning back enters into it, and becomes a *Capſula* or common cover for both Veins, Arteries, and Nerves. And whereas Anatomiſts did formerly teach, that this Vein upon its entrance into the Spleen, did preſently divide it ſelf therein into ſundry branches, and ſo was all equally obliterated in its Membranes and *Parenchyma*: he affirms, that there is formed out of it a large venous *Duct* or *Sinus*, that runs quite through the Spleen, (ſomewhat like that in the

The venous duct and tubuli.

Pancreas) into which the blood (howſoever alter'd) is received through the Glands from the Arteries: And becauſe he could never trace the Veins ſo far as the Glands, he believes that the blood, *&c.* is conveyed into the aforeſaid venous *Duct* by ſuch-like *tubuli* or pipes as the milk is ſtored up in and iſſues out of in Women's breaſts: and that by making ſome ſtay in theſe, it acquires ſome new mixture and alteration. That there are ſuch *tubuli*, appears from his own obſervation, (and from Dr. *Gliſſon*'s before him) that the Veins (eſpecially the venous Duct before-mentioned) have abundance of little holes or pores in their ſides, (every where ſave on that ſide under which the Arteries and Nerves run) which are extended into the *Parenchyma* of the Spleen, and conſtitute theſe little pipes.

This Vein enters the Spleen ſometimes in one and ſometimes in more branches: but whether they be one or more, they have each one a Valve, which looks from the Spleen outwards, permitting the humours to flow from the Spleen to the *Ramus ſplenicus*, but hindring them from returning back. And though one cannot diſcover any Anaſtomoſes of the Veins with the Arteries in the ſubſtance of the Spleen, yet there is one notable one of the Splenick Artery with this *Ramus ſplenicus* before it enter the Spleen. Whoſe uſe muſt be, partly to further the motion of the humours contained in the *Ramus* towards the Liver, partly that the ſuperfluous plenty of Blood, which perhaps cannot paſs quick enough through the narrow paſſages of the Spleen, may return back again by help of this Anaſtomoſis, through the *Ramus* to the Liver. There are alſo two Veins that open into the *Ramus* at a little diſtance from the Spleen; the *one* called *vas breve* (but ſhould rather be called *vaſa brevia*, there being for the moſt part ſeveral) which ariſeth out of the bottom of the Stomach: (The Errour of the Ancients as to the uſe of this Veſſel was detected before, *chap.* 12. and its true uſe declared:) and the *other* the internal Hemorrhoidal.

It hath two *Arteries*, entring one at its upper, the other at its lower part. Theſe commonly ſpring from the left Cœliack branch, which is called the *Splenick Artery*; but ſometimes (ſaith *Diemerbroeck*) from a certain branch which ariſeth out of the very trunk of the *Aorta*, and proceeds by a bending paſſage along the ſide of the *Pancreas* to the Spleen, approaching whereto it is divided into two, and theſe branches entring it as aforeſaid, they are ſubdivided through it into a thouſand twigs, the moſt of which terminate in the oval Glands above-deſcribed, and the remainder are ſpent partly on the Membranes that make its cells, and partly on the inveſting coats, as may be made to appear by filling this Artery with Ink or Air. 2. *Arteries.*

Its *Nerve* is one of the left meſenterical branches of the Intercoſtal pair, which at its entrance into the Spleen, is ordinarily divided into two branches, which are incloſed in the common caſe, running by the ſides of the Artery, or ſometimes above it, but under the Vein: Its ſubdiviſions do inoſculate with one another, and accompany the bifurcations of the Arteries within one cover through the whole ſubſtance of the Spleen, entring the Glands with the Arteries. Contrary to what has been formerly taught, that they are all ſpent on its inveſting Membrane; which was ſuppoſed, becauſe the body of the Spleen has but 3. *Nerves.*

but a very dull ſenſe: But that proceeds not from defect of Nerves, (ſeeing it has a pretty many twigs) but probably from that *ſtupor* or numbneſs which that acid juice that is bred in the Spleen, may be conceived to induce upon them.

Their Capſula. *Malpighius* in his accurate Anatomy of the Spleen, hath found out a conſiderable Membrane not obſerved by former Anatomiſts, which from its cloathing or incloſing the Blood-veſſels and Nerves, he calls a *common caſe* or *capſula*. It has its riſe from the inner and proper inveſting Membrane of the Spleen, (as was ſaid before in the deſcription of the Veins) which being turned back in the ingreſs of the veſſels enters to within the Spleen, and being formed into a pipe incloſes the trunks and branches alſo of the aforeſaid veſſels, which ſpring out of each ſide of the long *duct* or *ſinus*, ſomewhat like the leaves of Fern. It has ſuch like holes in it as the Veins before deſcribed: and the fibres of the Spleen do very many of them either ariſe from, or elſe are inſerted into it.

4. Vaſa Lymphatica. Though Dr. *Wharton* in his *Adenographia, cap.* 4. going about to prove the Spleen to be no Gland, uſes this as one Argument, That there were never obſerved any *Lympheducts* to be diſtributed through this part: yet *Olaus Rudbeck*, *Fr. Sylvius*, *Fred. Ruyſch*, *Malpighius*, *&c.* affirm it to have many, which ariſing from its conglobate Glands paſs through the *Omentum* very plainly into the *Receptaculum Chyli*. See them expreſt in the following figure of a Calf's Spleen.

The uſe of the Spleen. The Ancients knowing neither the true paſſage of the Chyle, nor the circulation of the Blood, erred groſly as to the *uſe* of this part. They thought that it attracted a more feculent and melancholick part of the Chyle, by the *Ramus ſplenicus*, from the Meſaraick veins, which having elaborated, it ſent it out again partly by the *vas breve* to the Stomach to excite the appetite and further the concoction thereof, and partly by the internal Hemorrhoidal: but it is certain, that no Chyle, nor indeed Blood paſſeth by the *Ramus ſplenicus* to the Spleen, as neither any thing *from* the Spleen by the aboveſaid Veſſels; but whatever they contain comes towards the Spleen, namely into the *Ramus*, and what is in it, goes to the Liver. One need add no further reaſon to evince the errour of their Opinion; nor that of thoſe that would make it either a blood-making, or a blood-perfecting Bowel. Dr. *Gliſſon* (in *lib. de Hepate, cap.* 45.*pag*. 434.) thinks it to make an Alimentary juice, or at leaſt a vehicle for it, which being firſt imbib'd by its nervous Fibres, is from them received into the Nerves, by which it is firſt carried to the *Glandulæ renales*; where being refin'd, it is received again by the Nerves, and is carried to the Brain and Spinal marrow, and from thence by the Nerves again into all the parts of the Body. We will not here enter into a diſpute about the nutritious juice of the Nerves; but ſuppoſing it, certainly this ſeems an odd way of conveying either it or its Vehicle thus to and again by the ſame ſort of Veſſels; not to ſay that ſo acid a juice as is excocted in the Spleen, one ſhould think, would be no very welcom gueſt to the Nerves, nor be ſuffer'd to march ſo quietly, eſpecially paſſing againſt the current of the Animal Spirits that continually flow from the Brain and Spinal marrow. This Opinion therefore we ſhall paſs by as very improbable, having little elſe to recommend it ſave the credit of its learned Author.

Velthuſius ſays, That whatever is more thick and feculent in the Chyle and Blood, is drawn to the Spleen, and there by fermentation is brought to a ſtate of fuſion and volatility, from whence ſtore of Spirits are bred in the blood; for 'tis by fermentation alone, ſays he, that Spirits are extracted out of any body.

Dr. *Mayow* according to his Hypotheſis, that the ferment of the Stomach conſiſts of Nitro-aereal Particles ſupplied by the Nerves, and that the ferments in all the other *viſcera* conſiſt of the ſame, aſſigns theſe three uſes to the Spleen. 1. That the Nitro-aereous Particles, which paſſing through the Brain in a continued *ſeries*, are not ſpent on the natural or animal functions, may be reconveyed (by thoſe Nerves that go to the Spleen, and which have communication with moſt of thoſe that are beſtowed on the *viſcera* in the *Abdomen)* into the maſs of blood, and rightly mixed with it in the Spleen. 2. That the Nitro-aereous Particles may be carried in a due plenty and with a certain regimen to the *viſcera* appointed for the concoction of Meats. For accordingly as thoſe *viſcera* are full or empty of Aliment, ſo they have need of a greater or leſs afflux of fermentative particles. 3. That the Nitro-aereous particles being put in motion and vigour, and intimately mixed with the Salino-ſulphureous particles of the blood in the Spleen, may excite ſuch an efferveſcency in the maſs of blood, as may be fit to bring its Salino-ſulphureous particles to a due volatility.] Whence, ſeeing theſe offices of the Spleen are not ſo neceſſary, but that life may be continued without them, though they much conduce to the right diſpoſition of the Animal Oeconomy and to a perfect health ; I ſay on this account he thinks it not difficult to underſtand how it comes to paſs that an Animal may live that has it cut out.

Blancard gives this as his Opinion. "The numerons Grape-ſtone-like Glands without doubt "receive a Lymphatick humour from the Arte- "rial Blood, which is carried by Lymphatick "veſſels, plain enough to be ſeen on the ſimous "ſide of the Spleen, to the receptacle of the "Chyle. The blood being thus deprived of a "too great quantity of this liquor, is made ſo "much the fitter to have the Bile ſeparated from "it in the Liver. Thus alſo all the blood that "is to go to the Liver, whether in the Spleen, "or in the Inteſtins, or in the Stomach, does "firſt part with its too thin juice. For this rea- "ſon the Spleen is made livid, and all the blood "that enters the Liver, is far blacker than that "which is contained in the *Vena cava.* But the "young Student will ask why the liquor is ſent "from the Lymphatick Veſſels of the Spleen into "the Receptacle of the Chyle? I anſwer, That "through the mixture of liquors whoſe particles "are of divers kinds, the Chyle might (by fer- "menting as it were, as appears in Chymical "mixtures) be made the more perfect.

The laſt, (and to me the moſt probable) *uſe* is this, *viz.* That it ſerves to make a ſubacid and ſaltiſh juice of the Arterial blood and Animal Spirits that flow plentifully into it, which paſſing by the *Ramus ſplenicus* to the Liver, ſerves there to make (and further the ſeparation of) the Bile, which is the proper action of the Liver, as was ſhewed before, *chap.* 11. Now this Juice is thus elaborated : The bulk of the Spleen conſiſting moſtly of membranous cells incloſing bunches of Glands, as we ſhewed before from *Malpighius*, into theſe the Arterial blood is poured by the capillary Arteries, wherewith are mixed ſome Animal Spirits depoſited into the ſame by the ends of the Nerves, which bridling the Sulphureous Spirit of the Blood, induce on it a little acidity ; and then being driven out of the Cells and Glandules, by the beating of the Arteries and the preſſure of the adjacent parts, it is received into thoſe *tubuli* before ſpoken of, and ſo into the large venous duct, from whence it flows into the *Ramus ſplenicus*, and by it is conveyed to the *Porta* and Liver. But it does not paſs haſtily through the Spleen, but ſeems to make ſome ſtay in the abovementioned Cells and Pipes, and alſo in the venous duct, that it may acquire ſome more acidity by its ſtagnating in them : as Wine ſtanding in a Vinegar-veſſel ſours more and more ; and as the Bile by ſtaying in the Gall-bladder gets a greater acrimony. And this ſtay of the blood in the *tubuli* and venous duct, *Malpighius* aſſigns this reaſon of, *viz.* becauſe they are ſo much more capacious than the Arteries that bring the blood into them ; ſo that the current could hardly be continued in them by the impreſs or propulſion of the Arterial blood, if it were not furthered by the motions of the adjacent *viſcera* and Inteſtins ſqueezing as it were the Spleen againſt the Ribs. That the Spleen does miniſter to the action of the Liver, and not to ſanguification (amongſt other reaſons) may be preſumed by this, that the Blood takes ſo long and tedious a march from that to this by the *Ramus ſplenicus* ; whereas it might readily have been

conveyed

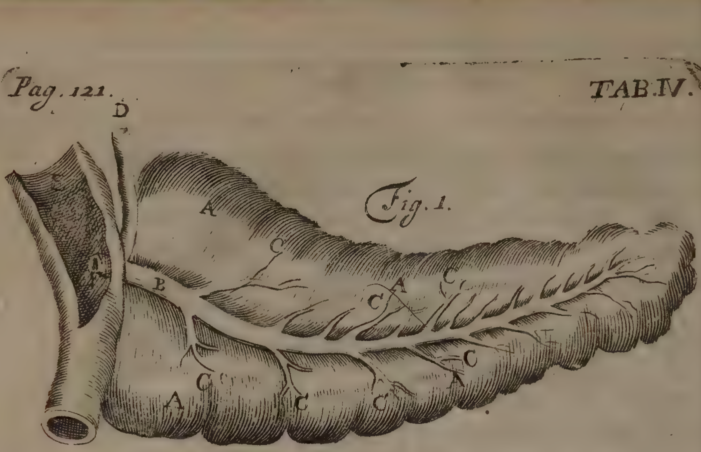


Fig. 1.

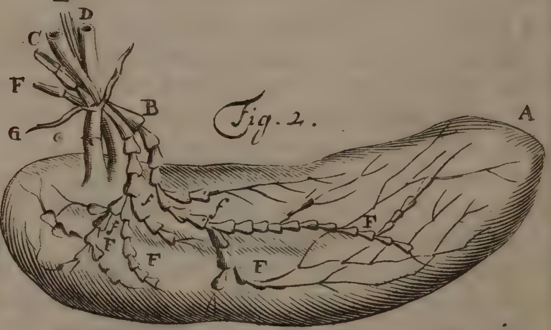


Fig. 2.

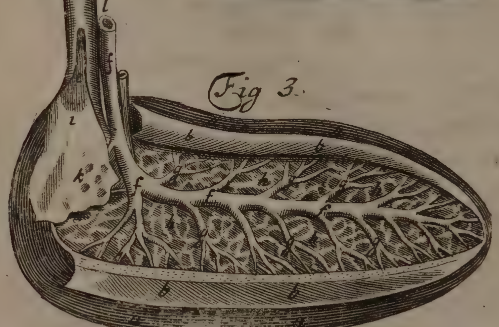


Fig. 3.

conveyed into the trunk of the *Cava* that is hard by the Spleen, if the juice that is elaborated in it had not been for the ſervice of the Liver.

Tab. IV. *Repreſents the* Pancreas, *and the Spleen with its Lymphedučts.*

Fig. 1. Repreſents the *Pancreas.*

AA *The* Parenchyma *of the* Pancreas *opened.*
B *The Trunk of the* Ductus pancreaticus.
CCC *Its Branches.*
D *The* Ductus bilarius *joyning to the Pancreatick Duct.*
E *The* Duodenum *opened.*
F *The inſertion of theſe Veſſels.*

Fig. 2. Repreſents the Lymphatick and Sanguineous Veſſels of the Spleen tied.

A *The Spleen of a Calf.*
B *The Sanguineous and Lymphatick Veſſels tied.*
C *The Splenick Vein.*
D *The Splenick Artery.*
E *The Splenick Nerves, whoſe number is uncertain.*
F *The Lymphatick Veſſels ariſing out of the outer part of the Spleen.*
f f f f *The Valves in the ſaid Veſſels.*
G *The Ligature.*

Fig. 3. Repreſents an Oxe's Spleen, from Dr. *Highmore.*

AA *The ſubſtance of the Spleen cover'd with its proper Coat.*
B *A portion of the* Vena portæ.

C *Its left, or Splenick Branch.*
D *This Branch opened near the Spleen that the Valve* b. *may appear.*
EE *The Coat of the Spleen diſſected and turned back, that the progreſs and* plexus *of the Veſſels and Fibres may be ſhewn the better.*
F *A portion of the Splenick Artery, which running through the whole ſubſtance of the Spleen, doth diſpenſe into it the little Twigs* aaa.
b *The Valve in the Splenick branch looking outwards to the* Porta.
ccc *The holes which appear in the* Ramus ſplenicus *leading from the ſubſtance of the Spleen.*
ddd *Nerves running along the ſides of the Splenick Artery.*

CHAP. XVII.

Of the Kidneys, and the Glandulæ renales.

The Kidneys. Their name. THE *Kidney* is called in Latin *Ren*, from ῥέω, to *flow*; becauſe the ſeroſity of the Blood doth flow through the Kidneys to the Ureters, and through them to the Bladder. By the Greeks they are called νεφροὶ, ἀ νείφειν *ningere*, or *ſpargere.*

Number. They are in *number* two, both becauſe of the great quantity of the ſerous Excrement that is to be ſeparated and diſcharged by them; and alſo that one being ſtopped by a Stone, or otherwiſe violated, the *ſerum* of the Blood might be tranſcolated by the other.

Situation. They are *ſeated* behind the Stomach and Inteſtins in the Loins, one on each ſide of the *Vertebræ*,

bræ, between the Membranes of the *Peritonæum* ; their lower end reſts on the head of the Muſcle *Pſoas* (which is one of the movers of the Thigh) juſt where the Nerve enters into it, which is the cauſe that a big ſtone being in the Kidney, and preſſing on the Nerve, a numbneſs is felt in the Thigh of the ſame ſide. In Man the right Kidney is loweſt, by reaſon of the greatneſs of his Liver, and commonly bigger alſo than the left ; yet it has not ſo much fat about it as the left, by reaſon of the vicinity of the Liver, whoſe heat hindreth the encreaſe of fat.

Figure.

In *figure* they reſemble the *Aſarum* leaf, or a Kidney-bean : towards the Loins or outwards they are gibbous ; and alſo in their ends on the inſide ; but in the middle where the Veſſels enter in and go out, they are hollow. Their ſurface in grown perſons is ſmooth, but in the *Fœtus* and Infants it is very unequal, as may be ſeen in the following figure of the Kidneys of an *Embryo.*

Connexion.

As for their *connexion* ; by the external fatty Membrane they are tyed to the Loins ; by the emulgent Veſſels, to the *Vena cava*, and the *Aorta* ; and by the Ureters to the Bladder. The right hath the *Inteſtinum cæcum* joyn'd to it, and ſometimes the Liver ; the left hath the Spleen and the *Colon.*

Bigneſs.

They are in length about five Inches, reaching the length of three and ſometimes four *vertebræ* ; betwixt two and three fingers breadth broad, and one Inch thick. In ſalacious or luſtful Men, they are commonly larger than in others.

Membranes
1. Common.

Their *Membranes* are two. The *outer* is *common*, borrowed from the *Peritonæum* ; within the reduplication of which the whole Kidney is wrapped; and therefore it is called *Renis faſcia.* This Membrane is beſmeared with much fat; whence it is called *Tunica adipoſa*; and into it entreth the *Arteria adipoſa* from the *Aorta*; as alſo the *Vena adipoſa*, which on the right ſide commonly ariſeth from the Emulgent, ſeldom from the *Cava*; but on the left, always from the *Cava*. By means of this Membrane 'tis that they are both joyned to the Loins; the right, to the *Cæcum* and ſometimes to the Liver; the left, to the Spleen and *Colon*, as was noted before.

The uſe of its Fat. Many *Uſes* have been aſſigned to the fat collected in this Membrane; as, to ſerve for a ſoft ſwathing-band to the Kidneys; to preſerve the hot and moiſt temperament of them, which otherwiſe would neceſſarily be reſolved by the continual affuſion of the ſerous Excrement, *&c.* But *Malpighius* thinks it more probable, that ſeeing much fat bedaubs the Veſſels that enter into the hollow ſide of the Kidneys, not only before their entrance but after, and that the ſame is extended to the Membranes of the *pelvis* and all its pipes, that therefore its chief uſe is, to beſmear the ſaid Veſſels through which the Urine paſſes, that they may not be fretted and excoriated by its acrimony and ſaltneſs.

2. *Proper.* The *inner* is *proper*, and ſeems to be connate with them, and not propagated from any part. It adhereth very cloſe to them, and has inſerted into it ſmall Nerves from the Intercoſtal pair, and one twig from that particular branch thereof which goes to the Stomach; whence that conſent betwixt the Kidneys and Stomach, that in the pain of the Stone in the Kidneys, a vomiting is cauſed. But theſe Nerves enter the *ſubſtance* of the

the Kidneys in but very few and thoſe ſmall ſlips; whence it has but a dull ſenſe. The emulgent Veſſels as they penetrate this Membrane, are ſaid to borrow from it a *Capſula* or common cover; (wherein they are both included;) as the Veſſels of the Spleen, and the *Porta* aud *porus bilarius* of the Liver, do from the Coat of their reſpective *viſcera*, as was ſhewn above in their deſcription. But * *Bellini* ſays, that theſe Veſſels in the Kidneys borrow their *Capſula* from the Membranes of the *pelvis*, within which they are diſperſed preſently upon their entrance into the Kidneys, and ſpringing out of them again, run to the cortical or ſuperficial part of the Kidneys clad with a common *Capſula* from thoſe Membranes.

* De ſtruct. Ren. p. 59, 60.

Subſtance.

As to the *ſubſtance* of the Kidneys (excepting the vaſcular part) it has been thought by ſome Anatomiſts to conſiſt of concrete blood or a *parenchyma*; by others, of a peculiar carnous ſubſtance; by others, that it is of a double nature, (becauſe of its different colour;) the outer part, which is of a dull red, to be a peculiar *parenchyma* like that of the Liver; and the inner, which looks paler, to be carnous, but fibrous. But howſoever their *ſubſtance* may appear to the naked eye, *Malpighius* with his Microſcope hath diſcovered it to be far other than it has hitherto been apprehended. He ſays (*lib. de Renibus cap.*1,2,3.) “That the Kidneys in Men are not of one continued frame, but conſiſt of ſeveral Globules, “as ſo many diſtinct Kidneys: That though in “grown Men their Superficies ſeems commonly “plain, yet it is unequal in Infants new-born; “and that in adult perſons the conjunction of “Globules does ſtill appear within from the di-

" verſity of colour, which in the ſeveral Globules outwardly and towards their ſides, whereby they joyn one to another, is red, but more pale towards their middle. Each Globule conſiſts of alike parts, namely of all thoſe which the whole Kidney partakes of, *viz.* of Blood-veſſels, Nerves, Glands, excretory Veſſels, and a *Papilla* in which the excretory veſſels terminate.——If one take off the Membrane from a freſh and as yet ſoft Kidney, there may by a good Microſcope be diſcovered certain round and very ſhort Bodies roll'd about like little Worms, not unlike thoſe that are found in the ſubſtance of the Teſticles being cut through the middle, or on their ſurface when their coverings are removed: The way to diſcover them is to pour Ink upon them, and then gently wipe it off; by the help whereof one may alſo diſcern, under the outmoſt ſurface, wonderful branchings of veſſels with their Globules (or Glands) hanging at them, like Apples. But for this purpoſe 'tis beſt to inject Ink by the Emulgent Artery; for thereby all the branches of the Artery will be tinged black, and ſo much of theſe Glandules as the capillary Arteries run through. Hereby one may alſo diſcover certain continued winding ſpaces and *ſinus*'s running through all the outward Superficies of the Kidneys. Then cut the Kidney in at the back lengthways as deep as to the *Pelvis*, and pour Ink upon it, which gently wipe off with your fingers end, and you will ſee innumerable ſmall pipes running from the ſurface towards the *Pelvis* as their centre, which look ſomething like fibrous or parenchymatous fleſh, but are indeed membranous and

" hollow; which pipes make up a great part of " the ſubſtance of the Kidneys, and are the excretory Veſſels of the Urine. But if you would " plainly diſcover theſe *tubuli*, you muſt have a " ſpecial care (in cutting of the Kidney in two) " that you cut ſtreightways of them, and not " ſloping, for then you cut them in two, and ſo " cannot trace them in their progreſs. From " the Glands into which the extremities of the " Arteries end, the roots of the Veins ariſe, and " he thinks that the Nerves reach to them too; " and that it is probable that the excretory veſſels of the Urine are extended ſo far alſo, ſeeing " this is conſtant in all Glands, that every little " Globule has beſides the Artery and Vein, a " proper excretory Veſſel, as the Bilary in the " Liver, &c. And he has obſerved that thoſe " ſame Pipes or Urinary Fibres running ſtreight " from the Glands towards the *Pelvis*, do many " of them terminate into one of the *Papillæ*, " through which the Urine is tranſcolated into " the *Pelvis*, for into it they jet out.] (Theſe *Papillæ* ſhall be deſcribed by and by.) By this curious and accurate deſcription of their ſubſtance, he has greatly diſpelled that miſt of ignorance that Anatomiſts hitherto were in concerning it. But to proceed.

Emulgents. *1. Arteries.*

The *Emulgent Artery*, ſpringing from the deſcending Trunk of the *Aorta*, enters the Kidney in its inner and hollow ſide, being firſt divided into two; but having entred it, theſe are ſubdivided into divers branches, which ſpreading themſelves between the coats of the *Pelvis*, ſhoot forth into ſmaller twigs; and theſe with the like twigs of the Veins borrowing a common *capſula* from thence, (according to *Bellini*, as was obſerved

ved before) run through the whole ſubſtance of the Kidney, and end in the Glands afore-mentioned. By this Artery (being large) is much blood conveyed to the Reins, partly to nouriſh them, but chiefly that in their Glandules a good part of the *Serum* may be ſeparated from it, which being carried by the Urinary fibres or pipes to the *Papillæ* ouzes through them into the *Pelvis*.

2. Veins. The *Emulgent Vein* is a little larger than the Artery. It has the like branching within the Kidney as the Artery; and its trunk coming out hard by where the Artery enters, opens into the *Cava*, into which it diſcharges the Blood remaining from the nouriſhment of the Kidney, now freed from a good quantity of *Serum* in the Glands. For that there paſſes nothing by this Vein to the Kidney is plain, *as* from the general office of Veins, which always carry from the part where their Capillaries are ſpread, (excepting the *Vena portæ*, which indeed has the office of an Artery) *ſo* from that notable Valve that is placed at its entrance into the *Cava*, looking towards it from the Kidney, ſo that the Blood may freely paſs out of the Emulgent into the *Cava*, but not back again. The Emulgent Vein ſometimes comes divided out of the Kidney, as the Artery goes in; but both the branches are preſently united into one, and it always opens by one Orifice into the *Cava*. The left Emulgent Vein is ſomewhat higher up than the right, according to the ſituation of the Kidneys themſelves, of which the left ſtands a little higher.

Nerves. Of the *Nerves* we have ſpoken before, diſcourſing of the proper Membrane of the Kidneys; to which we need add nothing more here.

Lymphe-ducts. Many, particularly *Malpighius*, have endeavoured to diſcover *Lympheducts* in them, without effect: But *Caſp. Bartholin* ſays, he can demonſtrate them to the Eye, and that for the moſt part they run to a Gland placed below the Kidneys on the left ſide, where having formed a various *plexus* of Veſſels, they tend to the Receptacle, being filled with *lympha* of a reddiſh colour.

The **Pelvis** *and* Papillæ.

Within the Kidney there is a membranous Cell or *Sinus*, called *Pelvis* or *Infundibulum*, (*i. e.* the Baſon or Tunnel) which is nothing but an extenſion or dilatation of the head of the *Ureter*; for it conſiſts of the ſame Membranes and Nervous fibres with it. It has certain Appendices which run in betwixt the *papillæ*, which are extended into membranous *fimbriæ*, and theſe parting into numerous fibres run towards, and are inſerted into, the proper Coat of the Kidneys, and ſerve to ſtrengthen their ſubſtance and to make it more compact, ſo that it is not eaſily violated even by the moſt violent motions and contortions of the Loins where the Kidneys are ſeated. The cavity of the *Pelvis* is not round, but branches it ſelf out into eight or ten (*Malpighius* ſays, twelve) open and large Pipes. Into it does the *Serum* iſſue from the Urinary Siphons through the *Carunculæ Papillares* or *Mammillares*, for one of theſe ſtands at the head of each of the ſaid Pipes, (being of an equal number with them) and are like Glandules, of a fainter colour but harder than the reſt of the *Parenchyma*; they are about as big as a Peaſe, flattiſh above, but round or bunching out on that ſide next the *Pelvis*; their perforations are exceeding narrow, ſo that they will hardly admit the ſmalleſt hair. Each one is the centre to all the Urinary *tubuli* in one Globule of the Kidneys; and through them does all the Urine ouze into the *Pelvis*, and none through any pores of the *Pelvis*, as ſome heretofore have imagined.

The action of the Kidneys.

The *action* of the Reins is to ſeparate and evacuate the ſerous humour from the Blood, which, as was ſaid, is brought to them together with the Blood, by the Emulgent Arteries; which is done in this order. After the two branches of the Emulgent Artery are enter'd the Kidneys, they are preſently each of them divided into four or five, and thoſe again into many more, till at laſt they end in the ſmalleſt Capillaries which terminate in the Glandules towards the outer Superficies, whereinto they infuſe their liquor. Into the ſame Glandules are inſerted alſo the Capillary veins, and the Urinary ſiphons, each of which imbibe thence their proper liquor. By the Veins the Blood returns into the larger branches of the Emulgent Veins, from thence into the ſingle Trunk, and by it to the *Cava*, which conducts it to the Heart: But by the Urinary pipes does the *Serum* drill to the *Papillæ* or *Carunculæ*, placed at the entrance into the *Pelvis*, through which it diſtils into it. And this *Pelvis* being the head of the *Ureter*, the *Serum* glides readily out of it down by the Ureter into the Bladder.

But now it is very difficult to determine, whether this ſeparation of the *Serum* in the Kidneys be procured by any kind of effervefcency or fermentation; or whether they ſerve merely as a ſtrainer, through which it is ſqueezed or tranſcolated. If it be ſeparated only this laſt way, how admirable is the configuration of the Pores that the *Serum* with all its contents ſhould paſs by them without the leaſt drop or ſtain of blood, when yet often purulent matter, brought out of the *Thorax*, and throughly mixed with the blood and which is far thicker than the blood it ſelf, paſſes through them with the *Serum*, and not any thing of blood at the ſame time! That ſuch purulent matter paſſes by Urine, is frequently obſerved; but whether it be abſorbed out of the Cavity of the *Thorax* by the mouths of the Veins gaping into it, as the Ancients thought it might; or it be bred in the *Parenchyma* of the Lungs apoſtemating, as is more probable, 'tis not a fit place here to enquire. As neither would it ſignifie much to give you the conjectures of ſome learned Men, that becauſe ſuch *Pus*, and much more becauſe Pins, Needles, an Iron Nail, *&c.* have paſſed by Urine; that therefore there muſt be ſome more direct and patent way for part of the *Serum* to be convey'd by to the Bladder; and therefore have imagined that ſome Lacteals have been inſerted into the Bladder, as others have ſuppoſed other ways: for as far as could ever be diſcover'd by Anatomiſts, there is no footſtep of any ſuch paſſage, how plauſible ſoever ſuch an *Hypotheſis* may ſeem. And therefore we ſhall ſay no further of it. As to the fermentation whereby ſome ſuppoſe the *Serum* to be ſeparated from the Blood, thoſe who are for it affirm that a Ferment is ſent for this purpoſe from the *Glandulæ renales* (to be deſcribed preſently.) But this cannot be admitted, ſeeing there appears no way whereby ſuch Ferment can be communicated, as ſhall be further ſhewed by and by. And the want of ſuch a way may ſerve for a Refutation of that other Opinion which ſuppoſes the Humour collected in the *Glandulæ renales* to perform the office of a *coagulum* or Runnet to the Blood in the

Kidneys, whereby the *Serum* is ſeparated from it like whey from milk.

Some have thought that the Kidneys, beſides the ſeparating of the *Serum*, do prepare matter for the Seed; ſeeing the ſpermatical Veſſels ſeem to have ſome manner of Communication with the Renal, the left ſpermatick Vein ariſing from the left Emulgent. But ſeeing the ſpermatick Vein returns blood from the Teſticles to the Emulgent, and carries nothing from this to them, this Opinion is exploded by the Circulation of the Blood. Yet however though they do not prepare Matter for Seed, yet by ſeparating the Salts and other Recrements, they amend the diſpoſition of the blood, ſo that it becomes more capable of being elaborated into Seed by the *Vaſa præparantia* and *Teſtes*.

Whether neceſſary Parts.

It is not abſolutely neceſſary for the conſervation of Life, that *both* the Kidneys ſhould be continued in a capacity to perform theſe Actions, tho' they are better performed by them jointly. For ſometimes the head of one Ureter is ſo plug'd up by a ſtone bred in the Kidney, that not a drop of *Serum* can paſs by it; and otherwhiles the whole parenchymatous (or glandulous) part is ſo conſumed by an ulcer, that no ſeparation of the *Serum* can be made by it; and yet the *Serum* is ſufficiently carried off by the other ſound Kidney. Yea, Dr. *Ant. Nuck* tells us, That after having ſtraitly tyed the Veſſels coming unto and going from the Spleen and one Kidney, in a Dog, he has cut them both out, and having healed up the wound in the ſide by which he performed the Operation, the Dog has continued as well after as if nothing had ail'd him.

Above

Glandulæ renales.

Above each Kidney at about half an inch diſtance there ſtands a Gland, firſt found out and deſcribed by *Bartholomæus Euſtachius*, by ſome called *Glandulæ renales*; by others, *Renes ſuccenturiati*; by *Bartholin*, *Capſulæ atrabilariæ*; by Dr. *Wharton*, *Glandulæ ad plexum nerveum ſitæ.* Which ſeveral Names they have had given them, from the ſeveral Uſes the Impoſers have aſcribed to them.

Their ſituation.

They are commonly but two, and are placed over (but towards the inſide of) the Kidneys, having the fat about the Kidney coming between. The left is nearer to the Diaphragm, ſtanding higher than the right, but the right is nearer to the *Vena cava.*

Figure and Subſtance.

They are ſeldom of the ſhape of the Kidneys, but are of not much unlike *ſubſtance*. Their *figure* is often three-corner'd, having the ſhape of a Satchel with its bottom upward. Sometimes they are oval but flattiſh.

Magnitude.

They are bigger in Children proportionably than in Men; for in the former they are near the bigneſs of their Kidneys (as may be gueſſed by the following figure of the Kidneys and theſe Glands in an *Embryo*;) but they do not increaſe as other parts do, ſo that in adult Perſons they are not above two inches long and one broad. Commonly the right is bigger than the left.

Membrane.

They are covered with a thin *Membrane*, which is knit very faſt to the outer or adipoſe Membrane of the Kidneys.

Cavity.

They have a manifeſt *Cavity* in their larger end, in which is contained a black and feculent Humour, that tinges the ſide of the Cavity. Into it there are a great many little holes gaping out of the ſubſtance of the Gland, according to Dr. *Wharton*; and it ſelf opens into a Vein, but has a Valve placed juſt at the entrance, that permits the humour contained in the Cavity to flow out by the Vein, but hinders its return.

Veſſels. They have *Veins* and *Arteries* commonly from the Emulgents, ſometimes from the *Cava* and *Aorta*, and ſometimes from the *Vaſa adipoſa*. Their *Nerves* come from the ſtomachick branch of the Intercoſtals, that runs to the proper Membrane of the Kidneys and to the Spleen alſo. *Lacteals* they have none. *Bartholin* affirms they have *Lymphaticks*.

Uſe. There have been divers conjectures of the *uſe* of theſe Glands, but none generally conſented to as true: Dr. *Wharton*'s gueſs is, that ſome humour is imbib'd from the Spleen by the Nerves that are common to the Spleen and theſe Glandules (being both from one branch) and is depoſited in their Cavity, which being not purely excrementitious (though perhaps unprofitable to the Nerves) is reſtored again to the Veins, as being of ſome uſe to the venal blood. Dr. *Gliſſon* alſo thinks they receive ſomething from the Spleen, which being refin'd here is imbib'd again by the Nerves, by which it aſcends to the Brain or Spinal marrow, and deſcends again by them, being either it ſelf a *Succus nutritius*, or elſe a Vehicle for it. *Riolanus* thinks they are of no uſe at all in Men, but only in the *Fœtus* in the Womb. *Veſlingius*, *Bartholin* and many others think that they make a ferment, or *Coagulum* for the uſe of the Kidneys to help the ſeparation of the *Serum* from the Blood. And this indeed were a probable uſe if there could be found out any way whereby ought could conveniently

fig. 1.

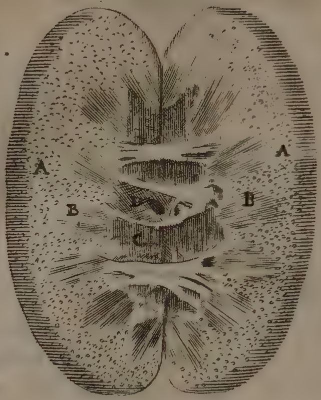


fig. 2.

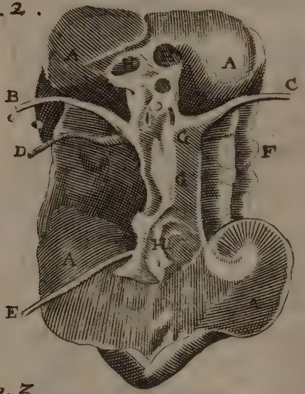
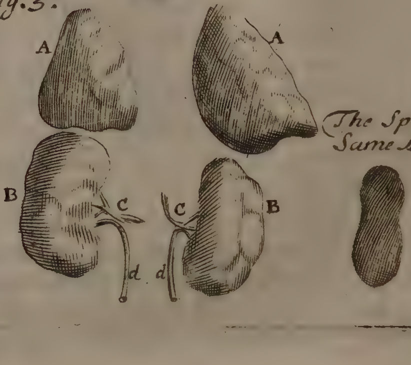


fig. 3.



The Spleen of the Same Abortion.

paſs from hence to the Kidneys. But the Veins that go out of them are inſerted either into the Emulgent Vein or into the *Cava*, whoſe Blood is flowing *from* the Kidneys, ſo that it cannot paſs *to* them, unleſs one would ſuppoſe a contrary courſe of humours in the ſame Veſſel, which ſeems abſurd. And there are no other Veſſels to ſerve this turn. *Diemerbroeck* conjectures, that their black juice is made of the Arterial Blood, and acquires a certain fermentative power neceſſary for the Venous Blood, into which it is received by the *Cava*, from the Veins that go out of theſe Glandules. But this, ſays he, is but a conjecture. And in truth all the other Opinions are no more, nor very probable ones neither; ſo that we muſt ſtill acknowledge our Ignorance of their true Uſe.

Tab. V.

Fig. I. Repreſents a Kidney cut in two lengthways, from the Back to the *Pelvis*.

AA *The glandulous part of the Kidney.*
BB *The* Tubuli urinarii *or Siphons, which convey the Urine ſeparated by the Glands, into the* Pelvis C.
D *The mouth of the* Ureter.

Fig. II. Shews the Aſpect of a Kidney cut lengthways from the *Ureter* to the *Pelvis*, from *Bellini*.

AAA *The Kidney diſſected as is ſaid.*
B *Half of the* Ureter *bent toward the right hand.*

C *The other half of the* Ureter *bent to the left hand.*
D *A branch of the Emulgent Vein.*
E *A branch of the Emulgent Artery.*
F *The* Pelvis *opened.*
GG *Some of the* Papillæ *through which the Urine iſſues into the* Pelvis.
I *The beginning of the* Ureter.

Fig. III. Repreſenteth the Kidneys and *Capſulæ Renales* in the ſame proportion as they appeared in an Abortion ſuppoſed to be about five months old, communicated to me by Dr. *E. Tyſon.*

AA *The* Glandulæ Renales, *which were rather bigger than the Kidneys themſelves.*
BB *The Kidneys, whoſe ſurface is very uneven, being divided into ſeveral Bodies as a Bullock's Kidney is.*
cc *The Emulgent Veſſels.*
dd *The Ureters.*

CHAP. XVIII.

Of the Ureters.

The Ureters. THE *Ureters*, in Latine *Meatus urinarii*, are called in Greek οὐρητῆρες, either from οὐρέειν, *to piſs*, or ὅτι οὖρον τηρέουσι, becauſe they *keep the Urine.*

Their Origine. They ariſe out of the inner *Sinus* or *Pelvis* of the Kidneys, coming out on their inner or concave ſide contiguous unto (but on the under ſide of) the Emulgents.

There

Number. There is one on each ſide.

Subſtance and Figure. They are ſomewhat like to Veins, but whiter, thicker, and more Nervous. They reach from the Kidneys to the Bladder, not in a direct line, but ſomething crooked like an Italick *ſ*. They are a little above a ſpan long, and as thick as a Barley-ſtraw naturally. But in ſuch as have had large Stones deſcend by them from the Kidneys to the Bladder, they have ſometimes become almoſt as wide as a ſmall Gut.

Coats and Veſſels. Their *Coats* are almoſt like thoſe of the Stomach and Guts, the inmoſt and outmoſt tendinous, and the middle carnous made up of two ranks of Fibres. They receive ſmall *Veins* and *Arteries* from the neighbouring parts. As to their *Nerves*, Dr. *Willis* ſaith, That after the Intercoſtals have ſent forth all the Meſenterick Nerves, each Trunk deſcending ſends forth three or four ſeveral ſlips that are carried into the Ureters, which makes the pain ſo very exquiſite when ſome viſcid matter or ſtone ſticks in them.

Paſſage and Inſertion. As they go out of the Kidneys they paſs over the Muſcles *Pſoæ* (which bend the Thigh) between the two Membranes of the *Peritonæum*, and deſcending as abovesaid, they are inſerted in the lower ſide of the Bladder, (near its neck) running between its two proper Coats about the length of an Inch, and continued with the inner.

Why the Inſertion is oblique. This inſertion is thus oblique, to hinder the regurgitation of the Urine, when the Bladder is either diſtended with Urine, or compreſſed in making water; for here is no Valve, as ſome have affirmed.

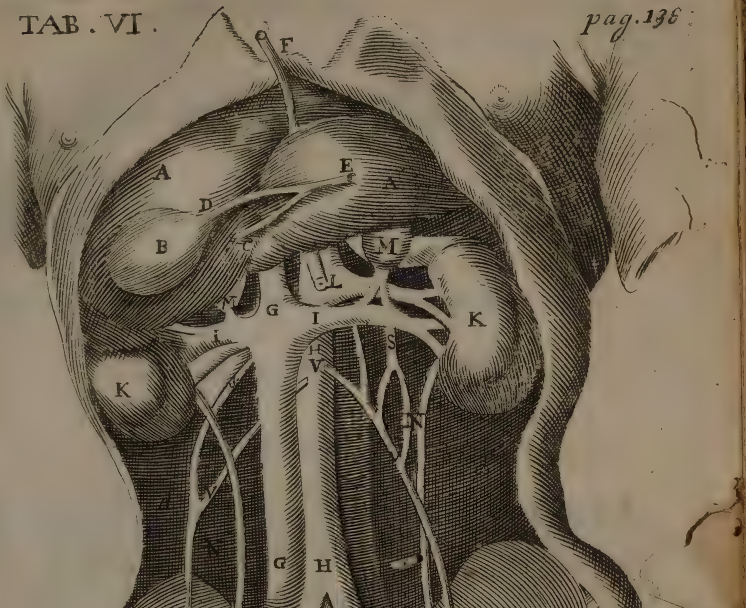
Uſe. Their *uſe* is to receive the Urine ſeparated from the Blood in the Kidneys, and to convey it into the Bladder, thence at diſcretion at certain times to be emptied out of the Body.

Tab. VI. ſhews the Liver, Kidneys, Bladder, Teſticles, *&c.*

AAA *The ſimous or hollow part of the Liver.*
B *The Gall-bladder.*
C *The* Ductus bilarius.
D *The Neck of the Gall-bladder.*
E *The* Ductus communis.
F *The Umbilical Vein turn'd upwards.*
GG *The deſcending Trunk of* Vena cava.
HH *The deſcending Trunk of the great Artery.*
II *The Emulgent Veins.*
KK *The Kidneys in their natural ſituation.*
LL *The Emulgent Arteries.*
MM *The* Glandulæ Renales, *with the Veins that go from them to the Emulgents.*
NN *The Ureters deſcending from the Kidneys to the Bladder.*
O *The bottom of the Bladder.*
PP *The inſertion of the Ureters into its ſides.*
QQ *A portion of the* Urachus.
R *A portion of the ſtreight Gut cut off.*
SS *The* Venæ præparantes, *the right whereof ſprings out of the Trunk of the* Cava, *the left out of the Emulgent Vein.*
T *The* Corpus pyramidale *expreſt on the left ſide.*
V *The riſe of the* Arteriæ præparantes *out of the trunk of the* Aorta.
uu *Their reception into one common cover with the Veins.*
XX *The Teſticles, the left whereof is diveſted of its common Coat.*
YY *The* Vaſa deferentia, *aſcending from the* Teſtes *to the* Abdomen.

Z *The*

TAB. VI.



Z *The Yard.*
aa *The Cod, that cover'd the left* Teſtis, *ſeparated from it.*
bb *The* Oſſa ilia.
cc *The* Oſſa pubis.
dd *The Loins.*

CHAP. XIX.

Of the Bladder.

The Bladder. Its name;

THE *Bladder* is called in Latin *Veſica urinaria*, in Greek κύϛις ȣ̓ροδόχος, from its office of *receiving the Urine.*

Seat and Connexion.

It is ſeated in the *Hypogaſtrium*, betwixt the two Coats of the *Peritonæum*, in that Cavity that is formed of the *Os ſacrum*, *coxæ* and *pubis*, and is called *Pelvis*. In Men it lies upon the *Inteſtinum rectum*; in Women it adheres to the Neck of the Womb, which is placed betwixt the Bladder and the ſtreight Gut: in both it is knit before to the *Oſſa pubis*. Moreover it is knit to the Navel by the *Urachus*.

Its ſubſtance is made up of three *Membranes*.

Membranes

The firſt and outmoſt is borrowed from the *Peritonæum*. *Riolanus* ſays, this Coat is a duplicature of the *Peritonæum*, within which the Bladder lies hid ſuſpended like a Bottle turned the mouth downwards. On its outſide in Man it is beſmear'd with fat, but not in Beaſts.

The ſecond is thicker, and endued with carnous Fibres; yea *Aquapendens*, *Spigelius*, *Walæus*, and *Bartholin*, will have it to be a true Muſcle, ſerving for the compreſſion of the Bladder, to ſqueeze out the Urine, as the Sphincter ſerveth for conſtriction, to retain it.

The third and innermoſt is white and bright, of exquiſite ſenſe, as thoſe can witneſs who are troubled with the Stone.

Within, it is covered with a ſlippery mucous humour, ſuch as the Gall-bladder has on its inſide, and ſuch as the Inteſtins abound with; which without doubt muſt be ſpued out of ſome Glands in this inmoſt Coat, though they be hardly diſcernable. This doth defend it from the acrimony of the Urine.

Fibres. Its Membranes have all ſorts of *Fibres.* And when theſe Membranes and Fibres are too long or too far extended with plenty of Urine, they loſe the power of contracting themſelves, whence there inſues a ſtoppage of Urine.

Perforations. It is *perforated* in three parts, *viz.* in the Sides, where the Ureters are inſerted, to let in the Urine; and before at its neck to let it out.

Parts, viz. It hath two *parts*, to wit, the Bottom and the Neck.

Bottom. The *Bottom* comprehends the upper, wider and more membranous part of the Bladder, to which the *Urachus* being tyed reaches the Navel, which, together with the bordering Umbilical Arteries, becomes a ſtrong Ligament in the adult, hindring the Bladder to preſs upon its neck. But as for the Arteries, *Riolanus* * affirms, That they contribute nothing to the ſuſpenſion of the Bladder, neither reaching to the Navel in the adult, nor touching the body of the Bladder. Of the *Urachus* ſee after, chap. 33.

* *In animadv. ad* Bauh.

Neck. The *Neck* is lower than the bottom, and ſtraiter. In Men it is longer and narrower, and being carried to the riſe of the Yard opens into the *Vrethra* ; in Women it is ſhorter and wider, and is implanted into the upper ſide of the *Vagina* of the Womb ; In both it is carnous and muſcular, woven of very many Fibres, eſpecially tranſverſe or orbicular, which lye hid within the ſtreight Fibres that ſurround the whole body of the Bladder, and theſe make the Sphincter, which conſtringes the neck of the Bladder ſo, as no Urine can paſs out againſt ones will, unleſs when it is affected with the Palſie or other malady, by which there ſometimes happens an involuntary piſſing.

Figure. The Bladder is oblong and round, in *ſhape* like unto a Pear.

Cavity. Its *Cavity* is but one ordinarily ; yet ſometimes it has been found to have a membranous partition, that divides it into two ; which yet had a hole in it for the communication of one Cavity with the other. Such a partition was obſerved in the Bladder of the Great *Caſaubon.*

Veſſels. It hath *Arteries* and *Veins* from the *Hypogaſtricæ*, which are inſerted into the ſides of its Neck, where they are immediately branched into two, whereof one is ſpent upon the Neck, and the other on the bottom. *Nerves* it hath (according to Dr. *Willis*) from the loweſt *Plexus* of the Intercoſtals in the *Abdomen*, and from the Marrow of *Os ſacrum.* For the ſaid *Plexus* ſending two Nerves into the *Pelvis*, they have each of them a Vertebral Nerve joyned to them, and ſo make two new *Plexus*, from one of which there paſſes a Nerve, that being divided into many branches, is on each ſide diſtributed into the Bladder and its *Sphincter.*

Uſe. The *uſe* of the Bladder is to receive the Urine from the Ureters, and to contain it, like a Chamber-pot, until the time of excretion, when it is ſqueezed out of it by the help partly of its own carnous Membrane, and partly of the Muſcles of the *Abdomen.*

Obſervations. *Bartholin* quotes ſome Obſervations of *Borrichius* concerning the Bladder, worthy to be noted, *viz.* If it be boil'd in acids, it turns into a Mucilage; if in ſalt liquors, it is thickned; if in oleous, or in the liquor of the Alkali ſalts of Tartar or Herbs burnt to aſhes, it is neither thickned nor turns into a Mucilage, but is burnt as if it were laid on burning Coals, and may almoſt be crumbled to powder. By which, ſays he, it appears, with what great danger to the Bladder Men inject into it either acid, ſalt, or oleous liquors for breaking the Stone.

CHAP. XX.

Of the Vaſa præparantia *in Man.*

Hitherto we have handled the parts miniſtring to *Nutrition*, whereby the Nutriments are prepared in the lower Belly for the ſuſtentation of an individual body, (and their Excrements ſeparated, and diſcharged out of the body;) Now we come to the Organs of *Generation*, whereby through procreation is conſerved a perennity of Mankind, which Nature hath denied to particulars. Theſe parts being not alike in both Sexes, we muſt neceſſarily treat of each apart, and firſt of thoſe of Men.

The parts of the Genitals in man.

In Man ſome of theſe parts afford matter for the Seed, to wit, the *Arteriæ ſpermaticæ*; others bring back again the Blood that is ſuperfluous to the making of the Seed and to the nouriſhment of the Teſticles, and theſe are the *Venæ ſpermaticæ*; and both theſe Arteries and Veins were formerly called *Vaſa præparantia*: ſome make the Seed, as the Stones; ſome convey it from thence to its conſervatory or ſtore-houſe, as the *Vaſa deferentia*: ſome contain the Seed till the time of Copulation, and theſe are the *Veſiculæ ſeminales*: ſome diſcharge the Seed into the Matrix in coition; this is done by the *Penis*: and ſome, laſtly, moiſten the paſſage, (*viz.* the *Urethra*) whereby the Seed iſſues, and thoſe are the Proſtates. Of all which in order. And firſt, of the

Vaſa præparantia.

Vaſa præparantia, which are ſaid to prepare matter for the Seed. Theſe are of two ſorts, *Arteries* and *Veins.*

Arteries.

The *Arteries* are two, and ſpring from the Trunk of the *Aorta*, commonly two Fingers breadth under the Emulgents, not from its ſide, but out of its fore-part, the right whereof climbing over the Trunk of the *Vena cava*, runs obliquely to the Vein of the ſame ſide; as alſo the left, marches to the Vein of that ſide.

Veins.

The *Veins* are alſo two. The right ariſes uſually from the Trunk of the *Vena cava*, a little below the Emulgent; the left from the Emulgent it ſelf, for otherwiſe it muſt have gone over the *Aorta*, whereby it might have been in danger of breaking; or rather by the continual pulſe of the Artery, the recourſe of the Venal blood might have been retarded. Now both theſe Veins and Arteries a little after their riſe meet, and are inveſted both in one Membrane made of the *Peritonæum*,

næum, and then run ſtreight through the region of the Loins above the Muſcles *Pſoæ* on each ſide, and above the Ureters; as they go, beſtowing little ſlips here and there upon the *Peritonæum*, between whoſe duplicature they deſcend, and ſo arrive at its proceſſes. The Veins divide very often into many branches, and by and by inoſculate and unite again; but the Arteries go along by one Pipe only on each ſide, until within three or four Fingers breadth of the Stones, where each is divided into two branches, the leſs whereof runs under the *Epididymis*, the larger to the Teſticle. And as I ſaid they deſcended betwixt the Membranes of the *Peritonæum*, ſo they paſs into the *Scrotum* between them, not perforating them in the proceſſes, as in Dogs and other Creatures, wherein the proceſſes of the *Peritonæum* are hollow like a Quill; but in Man the inner Membrane of the *Peritonæum* ſhuts the hole leſt the Inteſtins fall by it into the Cod; of which there is greater danger in him, (and we ſee it often happen) becauſe of his going upright. But to return to the *Vaſa præparantia*. It has been generally taught that there are divers inoſculations of the Arteries with the Veins in their paſſage, whereby the Venal and Arterial blood are mixed; but this Opinion is now exploded, for that, granting the circulation of the Blood, it is impoſſible. For the Blood in the Arteries deſcends towards the Teſticles, and that in the Veins aſcends from them, ſo that if theſe two Veſſels ſhould open one into the other, the blood in one of them muſt needs be driven back, or elſe, ſtagnating, diſtend and break the Veſſels. But the truth is, the blood both for the nouriſhment of the Teſticles and the making of Seed flows down by the Arteries only, and that in an even undivided courſe, without any of thoſe windings and twirlings like the Tendrels of Vines talk'd ſo much of, (as the curious *de Graef* from his own frequent inſpection teſtifies:) And the Veins bring back from the Teſticles what of the blood remains from their nouriſhment and making of Seed, and theſe indeed come out of their inmoſt Membrane by almoſt innumerable roots by which they imbibe the ſaid blood, and are moſt admirably interwoven and inoſculated one with another till about four or five Fingers breadth above the Teſticle, which ſpace is called *Corpus pyramidale*, *Plexus pampiniformis*, or *Varicoſus*; but theſe Veins are ſo far from preparing the Seed, as that they only bring back what was ſuperfluous from the making of it. And indeed the *Arteries* in Men do no more merit the name of *Præparantes* in reſpect to the Seed, than the *Gullet* in reſpect of the Chyle, or the *Ductus thoracicus chyliferus* in regard to the Blood; for their blood acquires no ſenſible alteration till it come to the Teſticles themſelves. But however we continue the old names, declaring only againſt the reaſon of them. And we will only note two things more. Firſt, That the Spermatick veins have from their riſe to their end ſeveral *Valves* which open upwards, and ſo ſuffer the blood to aſcend towards the *Cava*, but not to ſlide back again. Secondly, That though the Spermatick Arteries go ſuch a direct courſe in Men, as has been ſaid; yet in Brutes they are more complicated and twiſted with the *Veins*, but without any anaſtomoſes of one into the other.

There are *Nerves* and *Lympheducts* that accompany theſe *Vaſa præparantia*; of which in the next Chapter.

CHAP. XXI.

Of the Stones, or Teſticles, and the Epididymidæ.

The Stones. Their name.

THE *Stones* in Latin are called *Teſtes*, either becauſe they *teſtifie* one to be a Man, or becauſe amongſt the *Romans* none was admitted to bear *witneſs* but he that had them. In Greek they are called μήδεα, κύαμοι, and alſo δίδυμοι, *Twins*, becauſe according to Nature they are always two.

They are principal parts.

They are reckoned among the principal parts, and that juſtly; for though they are not neceſſary to the life of the *Individual*, yet they are, to the conſervation of the *Species*. Yea and by the loſs of them the *Individual* receives very great prejudice both as to the ſtrength and activity of his body, and as to the acuteneſs of his reaſon, &c. according to that of *Avenzoar*, *In Eunuchis malos agnoſcimus mores, rationis ſunt peſſimæ,——intellectus diminuti.*

Their ſubſtance.

They have a peculiar *ſubſtance*, (ſuch as is not in all the Body beſides) whitiſh and ſoft, made up of innumerable little ropes of Seed-carrying veſſels, which are continued (and by very thin Membranes tyed) to one another, carrying the Seed in their undiſcernable hollowneſs. The way to make theſe *Veſſels* viſible, *de Graef* has taught us, *viz.* Tye faſt the *Vas deferens* in a live-Dog or other Brute, and then theſe internal Ropes of veſſels otherways inconſpicuous, will preſently be ſo filled and diſtended with ſeminal matter, as that they may be eaſily diſcerned. *Galen*, Dr. *Wharton*, and of late *Peyerus*, *&c.* reckon them amongſt the Glands, and that with good reaſon.

Number, Situation, Figure, and Magnitude.

They are in *Number* two, hanging without the *Abdomen*, at the root of the Yard, in the Cod. Their *Figure* is oval, onely a little flattiſh. Their *Bigneſs* differs very much in ſeveral Perſons; as big as a Dove's Egg is reckon'd a mean ſize. *Hippocrates* held the right to be bigger and hotter than the left, and therefore called it ἀῤῥηγόνος, the *Male-getter*, as the left θαληγόνος, the *Female-begetter*. But theſe are fancies that are obſolete, and indeed ſeem ridiculous, ſeeing there is no ſuch difference of their bigneſs, and that their Veſſels are common.

Veſſels.

They have *Arteries* and *Veins* (as was ſaid before) from thoſe called *Vaſa præparantia*. Which ſome have thought to reach onely to the inmoſt Coat called *Tunica albuginea*, becauſe they are not conſpicuous in the inner ſubſtance of the Teſticles. But though this may be true of the Veins, which onely receive the ſuperfluous Arterial Blood, and have nothing to do with the Seed; yet it is not true of the Arteries, namely of the moſt numerous branches of them. Indeed Blood is ſeldom ſeen in the ſubſtance of the Teſticles, but that comes to paſs by reaſon that the Arterial Blood preſently loſes its colour, and by the ſeminifick faculty of the Stones is turned into Seed, which being whitiſh, of the ſame colour with the Veſſels, makes them undiſcernible. Yet in thoſe men that have died of languiſhing Diſeaſes,

eaſes, and whoſe *Teſtes* have their faculty impaired, *Diemerbroeck* affirms that he has oft diſcover'd ſanguiferous veſſels in the inmoſt parts of the Stones, and has ſhew'd them to many in the publick Anatomical Theatre. As for *Nerves*, Dr. *Willis* ſays he could never obſerve more to go to them than one from a Vertebral pair, and that too was moſt of it ſpent upon the Muſcle *Cremaſter*. *Diemerbroeck* agrees to one Nerve, but thinks it proceeds from the ſixth pair, (which is Dr. *Willis*'s Intercoſtal, as diſtinguiſh'd from that commonly called the ſixth, but his eighth.) Others will have branches from both theſe Nerves to go to them. Concerning the uſe of theſe Nerves there is great controverſie. Dr. *Gliſſon*, *Wharton*, &c. will have them to convey a *Succus genitalis*, which makes the greateſt part of the Seed. Dr. *Willis*, as he denies (*in Cerebri Anatome*, cap. 27.) any *Succus nutritius* to be conveyed by the Nerves to other parts, ſo that any *Succus genitalis* is brought by them hither, but onely animal Spirit. And whereas to ſtrengthen the former Opinion 'tis uſually objected, That the Seed muſt needs conſiſt of a nervous Juice and plenty of ſpirits brought from the Brain, becauſe of the great debility and enervation that is induced upon the Brain and Nerves by the too great expence of it: he thus anſwers, That this comes to paſs, becauſe after great profuſions of Seed, for the reſtauration of the ſame humour (whereof Nature is more ſollicitous than for the benefit of the Individual) a greater tribute of ſpirituous liquor is required from the Bloud to be beſtowed on the Teſticles: wherefore the Brain being defrauded of a due income and afflux of the ſaid ſpirituous liquor, languiſhes; and ſo the animal ſpirits failing in the fountain, the whole Nervous ſyſtem becomes depauperated and flaggy. Whereto may be added, that alſo the animal Spirits themſelves that actuate the *Proſtates*, being derived from the Spinal Marrow, are much waſted by venereal Acts; ſo that for this reaſon beſides, the Loins are enervated.] In this anſwer *Bartholin* acquieſces. And *de Graef*, *Diemerbroeck*, &c. confeſs indeed that the ſpirituous Arterial Blood is impregnated with Animal Spirits from the Nerves, but affirm, that the matter out of which the Seed is elaborated, is onely the ſaid Blood; and to theſe we ſubſcribe. *Lympheducts* they have alſo ariſing from betwixt their Coats, and aſcending upwards into the *Abdomen* with the *Vaſa deferentia.* Theſe have many Valves looking upwards, which hinder any thing from deſcending by them to the *Teſtes*, but permit the *Lympha* to aſcend, which they convey into the Chyliferous Veſſels. *Malpighius* thinks it not improbable, that ſome fat is derived to the ſeminary Veſſels, for the generation of Seed, or at leaſt to be mixt with it; ſeeing moſt Creatures grow the fatter upon being gelt.

They have two ſorts of *Coats*, proper and common. *Coats.*

The *common* inveſt both the *Teſtes*, and are two. The outermoſt conſiſts of the *Cuticula* and True skin (here thinner than in other places.) This is called *Scrotum*, hanging out of the *Abdomen* like a Purſe. It is ſoft and wrinkled, and without fat. On the outſide it has a Suture or Seam, that runs lengthways of the Cod, and divides it into the right and left ſide. The other or inner common Coat, is a carnous membrane, which ſeems to be muſcular, becauſe of the power it has to contract and wrinkle it ſelf. It is called δάρτος, and adheres to the proper Coat next under it (called *Vaginalis*) by many membranous Fibres.

The *proper* Coats are alſo two, and theſe encloſe each Stone apart. The outer is called *Elytroides*, or *Vaginalis*; becauſe it contains the Stone *as a ſheath.* It is a thick and ſtrong Membrane, having many *Veins*. In the outſide it is uneven, by reaſon of the Fibres by which it is knit to the *Dartos*; but in the inner ſide it is ſmooth. This is nothing elſe but the production of the *Peritonæum*, even as the *Scrotum* is of the Skin and *membrana carnoſa* of the *Abdomen.* Into this coat is inſerted the Muſcle *Cremaſter*, of which preſently. The inmoſt is ὑμὴν νευρώδης, the *Nervous membrane*, called *Albuginea*, from its colour. It is white, thick and ſtrong, framed of the external Tunicle of the *Vaſa præparantia.* It immediately enwraps the Stone, towards which it is rough, but on the outſide next the *Vaginalis* it is ſmooth; and between theſe two the Water is contained in an *Hernia aquoſa.*

Muſcles. Into the outer of the proper Membranes (as was ſaid) is inſerted the *Muſcle Cremaſter*. Theſe Muſcles (to each Stone one) have their riſe from the *Oſſa pubis*; and almoſt encompaſſing round the proceſſes of the *Peritonæum* deſcend with them to the Teſticles; where their carnous Fibres run through the whole length of this ſame *Tunica vaginalis*, eſpecially in its lower part, and ſo keep the Stones ſuſpended, from whence they have their name (from κρεμάζω *ſuſpendo.*) From their ſpreading themſelves thus on the outſide of the outer proper Coat, *Riolanus* reckons them for a third proper Coat, calling it *Erythroides*:

throides : and becauſe by its carnous Fibres it makes the *vaginalis* look *red*, ſuch as take it not for a diſtinct Coat, do give the name of *Erythroides* alſo to the *Vaginalis*, calling it by either name indifferently. Theſe Muſcles pull up the Stones in the act of generation, that the Veſſels, being ſlackned, may the more readily void the Seed : and at other times they help to ſuſtain their weight.

Theſe Muſcles in ſickneſs and old age become flaggy, and ſo the *Scrotum* relaxing it ſelf the Stones hang low.

Epididymidæ.

Upon the Stones, as yet clad with the *Tunica albuginea*, are fixed the *Epididymidæ* (called alſo *Paraſtatæ*, *Standers by*, or *Aſſiſtants*) enwrapped in the ſame Coat with the Spermatick veſſels. They adhere cloſer to the Teſticles at their ends than in the midſt. *De Graef* defines them to be *Veſſels making with their various windings that Body that is fix'd on the back of the Teſticles.* To find out their ſubſtance, he directs us thus. “ Firſt, “ take off the Membrane that encompaſſes them “ and knits them to the Stones, and then there “ will appear many windings, which with the “ edge of a Knife may without hurting the Veſ- “ ſels be ſo eaſily ſeparated from one another, “ that they may be drawn out into a length like “ a thing folded : for they are only folded from “ one ſide to the other, and are kept in that ſite “ by the Membrane received from the *Tunica* “ *albuginea* , (or *Spermatick veſſels.*) But when “ you have unravel'd half of them, you muſt cut “ another very thin Membrane, and then you “ will ſee other Veſſels lye juſt like theſe, and “ may be unlooſed like them. And the whole be- “ ing unravel'd, the thicker they are by how

" much further from their origine, which is im-
" planted into the upper part of the Teſticle by
" ſix or ſeven ramifications: which having run
" ſo far as where they joyn into one duct, make
" it as thick as a ſmall thread; and this by de-
" grees ſo thickens, that being encreas'd like a
" cord it makes the *Vas deferens*, (of which in
" the next Chapter.)

" So that (ſaith he) it is clear from hence, firſt,
" that the *Teſtes* do not differ from the *Epididy-*
" *midæ* (or *Paraſtatæ*) ſaving that thoſe conſiſt
" of divers ducts; but theſe, after their ſix or
" ſeven roots that ariſe out of the Teſticle are
" united, (which they are in a ſhort ſpace) but
" of one, only a little thicker. Secondly, that
" the *Epididymidæ* differ not from the *Vaſa de-*
" *ferentia*, ſaving that the former go by a ſer-
" pentine winding paſſage, and theſe by a
" ſtreight, and that thoſe are a little ſofter and
" narrower. And ſo (concludes he) following
" this *Ariadne*'s thread we have happily made
" our way out of the Labyrinth of the *Teſtes* and
" *Epididymidæ*.

Uſe. The *Uſes* of the *Stones* are two:

The firſt is to elaborate the Seed by the ſeminifick faculty reſident in them. For they turn a good part of the Blood, which is brought by the *Arteriæ præparantes*, and impregnated with Animal ſpirit, into Seed; ſome is ſpent on their own nutrition; and what remains from both, is carried back by the Veins called *Præparantes.*

The ſecond is, to add heat, ſtrength and courage to the Body, as gelding doth manifeſt, by the which all theſe are impaired.

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TAB. VII

Fig. 1.

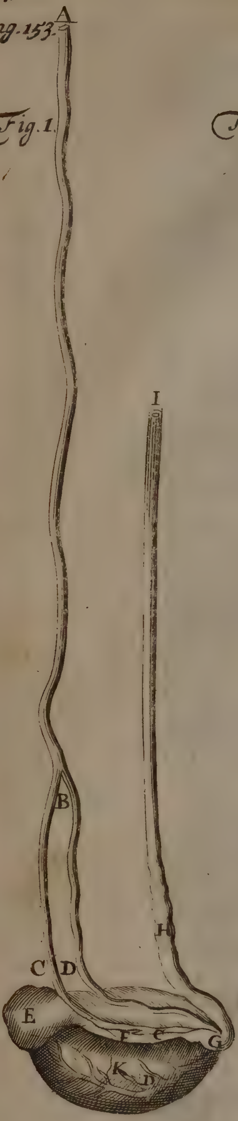


Fig. 2.

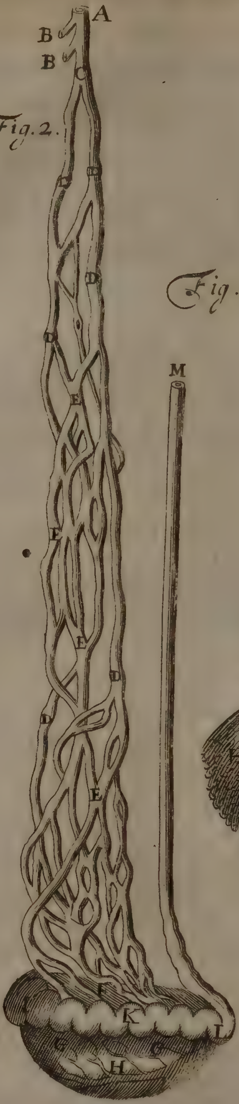
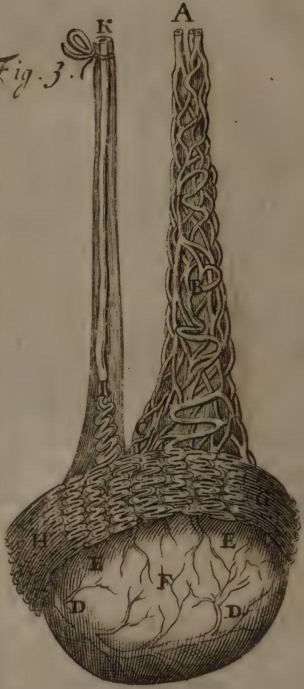


Fig. 3.



Tab. VII. ſhews the *Vaſa præparantia, Teſtes, Epididymidæ, Vaſa deferentia, &c.*

Figure I.

A *The Artery preparing Seed, running from the Trunk of the* Aorta *to the Teſticle.*
B *Its diviſion into two branches.*
CC *The leſſer branch thereof, which runs to the* Epididymidæ.
DD *The greater, which is implanted into the upper part of the Teſticle and deſcends along its back towards its lower part, to which the ſmaller end of the* Epididymis *is annexed; then it goes back again along the Belly of the Teſticle, where it is divided into many branches.*
E *The greater end of the* Epididymis *knit cloſe to the upper part of the Teſticle.*
F *The middle part of the* Epididymis *turn'd up, that the ramifications of the Artery that run along its lower part, may be ſeen.*
G *The ſmaller end of the* Epididymis *ſticking firmly to the lower part of the Teſticle.*
H *The end of the* Epididymis, *or beginning of the* Vas deferens.
I *The* Vas deferens *cut off, before it come to behind the Bladder.*
K *The Teſticle placed ſo as that its Veſſels may beſt be ſeen.*

Figure

Figure. II.

A *The Vein ſaid to prepare Seed running from the Trunk of the* Vena cava *to the Teſticle.*

BB *The branches of the* Vena præparans *tending to the Caul and* Peritonæum.

C *The firſt diviſion of it into two branches, which afterwards are wonderfully ſubdivided and united again.*

DDDDD *The Valves of the* Venæ præparantes, *about which the Veins being blown up appear knotty.*

EEEE *Very many diviſions and unions of the* Venæ præparantes, *that the Blood ſuperfluous from the generation of Seed, being detained in one ramification, may return to the Heart by the other.*

F *The upper part of the Teſticle into which the ramifications of the* Vena præparans *are implanted.*

G *The ramifications of the* Venæ præparantes *creeping along the ſides of the Teſticles through their white Coat.*

H *The Body of the Teſticle.*

I *The bigger end,* K *the middle, and* L *the ſmaller end of the* Epididymis.

M *The* Vas deferens *cut off almoſt in the middle.*

Figure III.

A *The Preparing Veſſels cut off.*

B *The Preparing Veſſels as they run to the* Teſticles.

C *Their ramifications tending to the* Epididymidæ.

D *The greateſt branch of the* Arteria præparans *running along the Belly of the Teſticle.*

EE *The ramifications of the* Venæ præparantes.

F *A Dog's* Teſticle *ſwelled with Seed.*

G *The bigger end of the* Epididymis *turgid with Seed.*
H *The leſſer end likewiſe turgid with Seed.*
I *The end of the* Epididymis *or the beginning of the* Vas deferens.
K *The* Vas deferens *of a Dog tied before the Coitus, the preparing Veſſels being unhurt, that the Seminary Veſſels being filled with Seed may be ſeen more apparently.*

CHAP. XXII.

Of the Vaſa deferentia, Veſiculæ ſeminales, *and* Proſtatæ.

Vaſa deferentia.

OUT of the *Epididymidæ* at their ſmaller end ariſe the two *Vaſa deferentia*, otherwiſe called *Ejaculatoria*, as if in *Coitu* the Seed were ſquirted from the Stones through them; which indeed was the common Opinion till the *Veſiculæ ſeminales* were found out, which are now known to be the ſtore-houſes of the Seed, and not the Stones. So that the *Vaſa deferentia* deſerve not the name of *Ejaculatory*, except it be that part of them which reaches from the *Veſiculæ ſeminales* to the *proſtatæ*, through which indeed the Seed is darted in copulation.

Their deſcription.

They are white, hardiſh bodies, like a pretty large Nerve, with a Cavity not very diſcernible, but which may be made ſo, if one open one of them ſix or ſeven Fingers breadth above the Teſticle, and then either blow into it with a ſmall Pipe, or ſquirt ſome colour'd liquor into it with a Syringe towards the *Teſtis*, for then the veſſel will be diſtended, and the colour will run along its Cavity towards the *Epididymidæ:* Or if you either blow, or ſquirt liquor by a Syringe the other way towards the *Veſiculæ ſeminales*, the ſaid *Veſiculæ* will be diſtended.

Progreſs. Now from the *Epididymidæ* theſe *Vaſa deferentia* aſcend, and paſs out of the Cod into the *Abdomen* the ſame way by which the *Vaſa præparantia* came down, *viz.* by the proceſs of the *Peritonæum.* When they are entred the *Abdomen*, they are carried preſently over the Ureters, and turning back again they paſs to the backſide of the Bladder; between which and the *Inteſtinum rectum* they march at a little diſtance the one from the other till about the Neck of the Bladder, where they grow wider and thicker: and then juſt as they are going to meet, their ſides open into the *Veſiculæ ſeminales*, in which they depoſite the Seed; but not terminating here, but coming cloſe together and growing ſmaller and ſmaller, they go on and end at the *Urethra* betwixt the *Proſtatæ.*

Veſiculæ ſeminales. Theſe *Veſiculæ* are little Cells like thoſe in a Pomegranate, or ſomething like a bunch of Grapes; *de Graef* compares them to the Guts of a little Bird diverſly contorted. They conſiſt of one thin Membrane, through which ſome ſmall twigs of both Veins, Arteries and Nerves run. They are about three Fingers-breadth long, and one broad; but in ſome places broader and ſome narrower, as they run in and out. They are two, (one for each *Vas deferens*) divided from one another by a little interſtice; and they do ſeverally by a peculiar paſſage emit the Seed contained in them into the *Urethra.* They are very anfractuous and winding, and (as was ſaid) conſiſt of many little Cells, that they ſhould not pour out all the Seed contained in them, in one act of Copulation, but might retain it for ſeveral. They have no communication one with another, not even in their very opening into the *Urethra*; but the Seed that is brought to the *Veſiculæ ſeminales* on the right ſide by the right *vas deferens*, iſſues by its proper paſſage into the *Urethra*; and that which is brought to the left likewiſe. So that if by any accident the *Veſiculæ* on one ſide be burſt or cut, (as in cutting for the Stone they generally are) yet thoſe on the other being intire may ſtill ſuffice for generation. Now when the Seed is emitted out of theſe *Veſiculæ* in the act of generation, it paſſes out the ſame way it came in; which in this caſe may eaſily be, (though otherwiſe it be unuſual there ſhould be a contrary motion in the ſame veſſel) for as it comes in from the *vaſa deferentia*, it drills along *gently* without any force; but in *Coitu* when the Muſcles of the Yard and all the bordering parts are much tumified, it is expreſſed or ſquirted out of them with ſome *violence*, and paſſing along their neck, (which is a continuation of the *vaſa deferentia*) ouzes through a Caruncle (like Quickſilver through Leather) into the *Urethra*, or the Duct of the Yard that is common both to Seed and Urine. I ſay it ouzes from the necks of the *veſiculæ* through a Caruncle into the *Urethra*, for there is one plac'd as a valve before the orifice of each of them; partly to hinder the coming of the Urine into them, partly to hinder the involuntary effuſion of the Seed.

Now though naturally the little holes through which the Seed paſſes out of the necks of the *veſiculæ* into the *Urethra* be almoſt imperceptible; yet if they be either eroded by the acrimony of the Seed (ſuch acrimony as is contracted by impure embraces, or in Claps as we call them) or if of themſelves they be debilitated and ſo become more lax, (as ſometimes happens to old or impotent Men that meddle too much) then there happens a *Gonorrhœa* or continual efflux of Seed. And ſo *Veſalius* and *Spigelius* have obſerved them much dilated, in diſſecting ſuch as have died with a *Gonorrhœa* upon them.

Proſtatæ. The *Proſtatæ* are placed near to the *veſiculæ ſeminales*; *de Graef* calls them *Corpus glandoſum*, ſuppoſing them to be one body, and only divided by the common Ducts of the *veſiculæ ſeminales* and *vaſa deferentia* coming through the midſt of it. They are of a white, ſpongy and glandulous ſubſtance, about as big as a ſmall Walnut, encompaſs'd with a ſtrong and fibrous Membrane from the Bladder, to the beginning of whoſe neck they are joyned at the root of the Yard. In ſhape they come nearer to an oval, ſave that on their upper and lower part they are a little depreſt, and in that end by which the *vaſa deferentia* enter, they are ſomething hollow like a Tunnel. The Sphincter muſcle of the Bladder encompaſſes them, ſo that for ſo far as they cover the neck of the Bladder, the Sphincter touches it not, they coming between. They have all ſorts of Veſſels, which run moſtly on their outer ſide. In their inner part they have ten or more ſmall Ducts which all unload themſelves into the *Urethra* by the ſides of the great Caruncle (through which the Seed paſſes from the *veſiculæ* into the *Urethra*) but themſelves have each one a ſmall one to ſtop its orifice, leſt the liquor that is contained in the Proſtates ſhould continually flow out, or the Urine ſhould flow in. And theſe ſmall Ducts I ſuppoſe are continued from thoſe *veſiculæ* which appear in the Proſtates of thoſe that die (any way) ſuddenly after having had to do with a Female. For in ſuch, the ſpongy part of the *Proſtatæ* is very turgid with a ſerous liquor, and in their inner part may be found theſe ſame *veſiculæ*, like to *Hydatides*, which if you preſs upon, they will diſcharge themſelves into the abovesaid Ducts.

What the liquor they contain ſhould be, or what is their uſe, there is great variety of Opinions. Some think that the Seed that flows from the Teſticles, is further elaborated here. But that cannot be; for that the *vaſa deferentia* depoſite nothing in them, but all into the *veſiculæ ſeminales*. Others think that from the blood there is ſeparated in them an acrimonious and ſerous humour, which ſerves for titillation or cauſing the greater pleaſure in Venery. As to this, *de Graef* appeals to the taſte of it, which has nothing of acrimony. Dr. *Wharton* thinks they make a particular kind of Seed, as the Teſticles do another, and the *veſiculæ ſeminales* a third. That theſe laſt make a Seed different from that made in the Teſticles is grounded on a miſtake in Anatomy, *viz.* that the *vaſa deferentia* have no communication with the *veſiculæ*, whereas they apparently open into them, and depoſite in them all the Seed they contain. That the *Proſtatæ* make a peculiar ſort, he endeavours to prove, becauſe gelded Animals emit ſome Seed. *Their uſe.*

But that is but precarious; for though they emit ſomething, 'tis not neceſſary it ſhould be any true Seed. Or if it be, it may well be ſuppoſed to proceed from the *Veſiculæ ſeminales* that have been full when the Animal was gelt. For, for this reaſon it has been obſerved that preſently after gelding they have ſometimes got the Female with young, but not afterwards when that ſtock was ſpent. *Bartholin* with many others thinks they make an oily, ſlippery, and fat humour, which is preſſed out, as there is need, to beſmear the *Vrethra*, whereby to defend it from the acrimony of the Seed and Urine, and leſt it ſhould dry up. This Humour *Malpighius* thinks to be conveyed hither by *Ductus adipoſi*; and quotes *Severinus*, affirming that he has obſerved a plain veſſel in the Fat of the Kidneys, tending to the Spermatick veſſels. He aſcribes the ſame uſe to it as *Bartholin*, *&c.* *Diemerbroeck* confeſſes that it is neceſſary the inſide of the *Vrethra* ſhould be kept moiſt and ſlippery, but thinks that that is done here as in the Bladder, Inteſtins and many other places, namely from ſome mucid part of the nouriſhment of the *Vrethra* it ſelf; and concludes that the *Vaſa deferentia* depoſite not all the Seed into the *veſiculæ ſeminales*, but carry a ſmaller part to theſe *Proſtatæ*. *De Graef* denies that the *Vaſa deferentia* convey any thing to them, or have any communication with them; and therefore believes, that the Humour that is ſeparated in the *Corpus glandoſum* (as he calls the *Proſtatæ*) ſerves for a *Menſtruum* or Vehicle of the Seed, which flowing but in ſmall quantity through ſmall pores into the *Vrethra*, it was neceſſary that this Humour ſhould be mixt with it, that it might better reach the Womb. Whatever

ever this Humour be, it is ſqueezed out partly by the intumeſcence and erection of the *Penis*, and partly by the compreſſion of the Sphincter of the Bladder that girds the *Proſtatæ* about.

Theſe Proſtates are often (at leaſt partly) the ſeat of the *Gonorrhœa*; and the humour that they contain, that which is ſhed: for, if it were true Seed, men could never endure a *Gonorrhœa* ſo long without more notable weakning and emaciating, the flux being ſo large as ſometimes it is.

I ſhall here omit all Philoſophical Enquiries into the nature of the Seed, contenting my ſelf purely with the Anatomical part. How far it contributes to the generation or formation of the *fœtus*, ſhall be ſhewn afterwards, chap. 30. *of a Conception.*

Perinæum.

Why theſe parts in men are hairy.

The diſtance betwixt the root of the *Cod* and the *Podex* is called *Perinæum*, *ἀ περινέω*, *circumfluo*, becauſe it is generally moiſt with ſweat. By the Latins it is named *Interfemineum*, becauſe it is placed *inter femora*, between the Thighs. In ripe or grown perſons this part, the *Pubes*, *Scroton* and the circuit of the *Podex* are clad with hair, which ſerves as a veil to cover theſe obſcene parts.

CHAP. XXIII.

Of the Yard.

The Yard. THE Seed being elaborated and treaſured up in the aforeſaid Organs, there was need of a peculiar Inſtrument whereby it might be conveyed into the Womb of the Female; and to this purpoſe Nature has furniſhed the Male with a *Yard*, which we come now to anatomize.

Its name. It is called in Latin *Penis*, *à pendendo*, becauſe it hangeth without the Belly. Alſo *Virga*, *Membrum virile*, *Veretrum*, *Mentula*, and by many other names invented by luſtful perſons and laſcivious Poets.

Deſcription. It is an Organical part, long and round, yet ſomewhat flat on the upper ſide, ſeated under the *Oſſa pubis*; appointed partly for making of water, but principally for conveying the Seed into the Matrix.

Magnitude. As to its thickneſs or length, it differs much in divers Men. But it is generally obſerved to be larger in ſhort Men, and ſuch as are not much given to Venery; alſo in thoſe that have high and long Noſes, and that are ſtupid and half witted.

Subſtance. It is neither bony, as in a Dog, Fox, Wolf; nor griſtly nor fleſhy; but is framed of a peculiar ſubſtance, ſuch as might moſt conveniently admit of diſtention and relaxation.

Parts. The *parts* of it are either *common* or *proper*.

The *common* are three, the Cuticle, the Skin, and the *Membrana carnoſa*, which we ſhall not need to deſcribe.

It hath no *fat*, for firſt that would have hindred its erection into that ſtiffneſs that is neceſſary; and ſecondly would have occaſion'd it to grow too bulky; and laſtly would have dull'd that great pleaſure that in Venery the Male is affected with in this part. *Why it hath no fat.*

The *proper* or internal parts are theſe: the two Nervous bodies, the *Septum*, the *Urethra*, the *Glans*, four Muſcles, and the Veſſels.

The *Nervous bodies* (ſo called) are encompaſſed with a thick, white, nervous, and very firm Membrane, (like an Artery) but their inner ſubſtance is ſpongy, being moſtly a contexture of Veins, Arteries, and Nervous fibres, woven one with another like a Net; and when the Nerves are filled with Animal ſpirit, and the Arteries with hot and ſpirituous blood, then the *Penis* is diſtended and becomes erect: but when the Spirits ceaſe to flow in, then the Blood and remaining Spirits are abſorbed by the Veins, and ſo the *Penis* becomes limber and flaggy. *The nervous bodies.*

They ſpring from the lower ſide of the *Oſſa pubis* at diſtinct originals, where they appear like two horns, or are of a figure reſembling the Letter Y, that the *Urethra* may have room to paſs between them. When they leave the *Oſſa pubis* they are each covered with a ſeveral Membrane, and are afterwards joyned together with only the *Septum* between, which the nearer it comes towards the *Glans*, is the thinner, ſo that before it come to the middle of the *Penis* its Fibres extend towards the back of the Yard from the *Urethra* in order like a Weaver's Slay, and while it ſtill goes further, its Fibres by degrees grow ſo very ſmall, that near the *Glans* the *Septum* is almoſt obliterated, and the two Nervous bodies grow into one. Whence it is that the *Penis* is equally erected; for if the *Septum* had exactly diſtinguiſh'd one part from the other, it might ſometimes have ſo hapned by the compreſſion or obſtruction of the Arteries of the one or the other ſide, that one part of it would have been extended, and the other remained flaggy.

Dr. *Wharton* affirms, theſe Nervous bodies have Glandulous fleſh within them, which keeps the Yard ſomething plump even when it is not erect. But *de Graef* denies this, and demonſtrates, that they have no other ſubſtance than beforeſaid, thus. Let the Yard be prepared thus: Firſt gently ſqueeze the blood out of it, which it always has in greater or leſſer plenty, and then put a little Tube into the ſpongy ſubſtance, namely in at that end that is next to the *Os pubis*; and let the Cavity of the *Penis* be half fill'd with water by the help of a Syringe, and ſhake the *Penis* with the water in it: pour out that bloody water, and fill it again with clear, and ſo three or four times till the water is no longer ſtain'd with blood. Then betwixt two linnen clothes ſqueeze out what water is in the Nervous bodies, and at length blow up the *Penis* ſo long till it have its natural bigneſs; in which poſture if you will keep it, you muſt tye it hard. When the *Penis* is thus diſtended and dried, you may examine it as you pleaſe, and will find no other ſubſtance than was mentioned. *Diemerbroeck* ſays, that their ſubſtance is not a mere texture of Veſſels, but is fibrous, fungous and cavernous, (ſuch as is the ſubſtance of the Lungs) receiving in their hollow Interſtices Blood and Spirits out of the Veſſels that are diſperſed through their ſubſtance.

Below theſe Nervous bodies lies the *Urethra*, being of a much like ſubſtance to them, ſaving that its ſpongy part, which is outer and lower, hath leſs pores becauſe of its ſmaller and more plentiful Fibres. This part does tumifie whenſoever the Nervous bodies do. Its inner part is membranous, round and hollow, and exceeding ſenſible. It is of an equal largeneſs from one end to the other, ſave in its fore-part, where the *Glans* is joyned to the Nervous bodies, for there it hath a ſmall Cavern, into which the acrimonious Urine lighting in the Stone of the Bladder, while it wheels about in it, cauſeth pain, and is a great ſign of the Stone. Sometimes alſo the acrimonious eroding liquor in a *Gonorrhœa* ſtaying here, doth cauſe a moſt tormenting ulceration. *The* Urethra.

It is continuous to the neck of the Bladder, but has not its riſe from it, nor is of the ſame kind of ſubſtance. If you boil the Bladder and it, it will eaſily ſeparate, and appears of a clear other ſubſtance and colour. It begins at the neck of the Bladder and reaches to the end of the *Glans*, which it ſeems to beſtow a Membrane upon from its own inner one, for it is plainly continued from it.

Its *Uſe* is to convey along the Seed and Urine. And to that end there open into it ſmall pores that tranſmit the Seed into it from the necks of the *Veſiculæ ſeminales*, (of which in the foregoing Chapter;) and alſo the neck of the *Veſica Urinaria* which pours out the Urine into it. *Its uſe.*

The *Muſcles* are two on each ſide, and ſo four in all. Of theſe one pair are called by ſome, Collateral Muſcles, by others *Erectores*. Theſe are ſhorter and thicker, and ſpring from the *appendix* *Muſcles.*

dix or knob of the *Coxendix*, under the beginning of the Nervous bodies, and are inſerted into the ſame, a little from their beginning. Theſe ſerve for erection of the *Penis*.

The ſecond pair is longer and ſmaller, proceeding from the Sphincter of the *Anus*. Theſe paſs ſtreight by the ſides of the *Urethra*, and are inſerted into it about its middle; they ſerve to dilate it for miction and ejaculation of the Seed, and are called *Dilatantes*, wideners, and *Acceleratores*, haſtners.

Theſe have been generally held to be the uſes of theſe Muſcles, but *de Graef* (as alſo *Swammerdam*, *not. in prodr. p.* 35.) aſſigns a clear contrary uſe to them, and that with great ſhew of reaſon. For ſeeing the action of a Muſcle is contraction, how ſhould the former pair extend the *Penis*, and not rather draw it back towards their original? Or how ſhould the latter ſerve to dilate the *Urethra*, and not rather ſtraiten it, ſeeing in the action or contraction of a Muſcle its Belly or Middle ſwells? Therefore he ſays that the Muſcles only contribute thus far or in this reſpect to the extenſion or erection of the *Penis*, inaſmuch as by their ſwelling (partly by blood and ſpirit flowing into them, partly by their proper action) they ſerve to ſtraiten and compreſs the roots of the Nervous bodies and the ſpongy part of the *Urethra*, and ſo drive the blood that flows in by the Arteries towards the *Glans*, and hinder its returning back again by the Veins: a reſemblance whereof may be exhibited by a piece of a Gut, which if we fill with wind or water, and then compreſs that end by which they enter'd, (the other being ty'd) we ſhall ſee the other ſtrut out and be more diſtended.

The end or head of the *Penis* is called *Glans*, Glans. and *Balanus*. Into this the Nervous bodies terminate; and being a little thicker (on that ſide next them) than they, it forms a kind of a circle. On its fore-part it is ſmaller and ſharper. It has a peculiar ſubſtance (Dr. *Wharton* ſays glandulous) ſoft and ſpongy, and being covered with a very thin Membrane produced from the internal one of the *Urethra* (which coming out of its hollow, dilates it ſelf ſo as to cover all the *Glans*) it thereby, and from its proper ſubſtance much interwoven with Nerves, becomes moſt exquiſitely ſenſible, and is the principal ſeat of pleaſure in copulation. Which if it had not been very great, who would have taken delight in ſo brutiſh a thing as Venery? as *Andreas Laurentius* elegantly expoſtulates, (*Anat. lib. 7. cap. 1. q. 7.*)
“ Who (moſt ſtrange!) would have ſolicited or
“ accepted of ſo vile and filthy a thing as lying
“ with a Woman? With what face would Man,
“ that divine Animal, full of reaſon and counſel,
“ have handled the obſcene parts of Women pol-
“ luted with ſo much filth, which is diſcharged
“ into this low place as into the common ſink of
“ the Body? On the other ſide, what Woman
“ would have accepted of the embraces of a Man,
“ conſidering the toil and tedioufneſs of going
“ nine months with Child, the moſt painful and
“ often fatal bearing of it, and its Education full
“ of care and anxiety, unleſs the Genitals had
“ been affected in the act of coition with tran-
“ ſporting pleaſure?

The *Glans* is covered with the *Præputium*, or Præputium. Fore-skin, which is framed of the reduplication of the Skin.

It is called *Præputium*, becauſe it is placed *præ* *pudendo* before the Yard: or rather *à præputando* from being cut off, for this is that which the *Jews* cut off in Circumciſion, from whence they are called *Apellæ* and *Recutiti*. And it is reported by divers perſons from their own inſpection, that in Jewiſh Children it is ſix times as large as in Chriſtians, and hangs a great way over the *Glans*, before it be cut off.

Frænum. The Ligament by which the Prepuce is tyed to the *Glans* in the lower part of it, is called *Frænum*, the Bridle.

The Veſſels. Of the *Veſſels*, ſome are *cutaneous*, ſome paſs to the *inner* parts of the *Penis*.

Veins and Arteries. The *cutaneous Veins* and *Arteries* ſpring from the *Pudendæ*; theſe entring at the root of the Yard, paſs by the ſides towards the back of it, and are conſpicuous enough. The Veſſels which are beſtowed upon the *inner* parts of it, come from the *Venæ* and *Arteriæ hypogaſtricæ*, and enter juſt at the meeting of the two Nervous bodies, through whoſe length they run, and are moſtly diſperſed in them, and in the fungous part of the *Urethra*, ſending forth little twigs at the ſides.

Nerves. It has two *Nerves* from the loweſt Vertebral. The greater of them, that is very large and long, is diſtributed into the Nervous bodies, *Urethra* and *Glans*; the leſſer is beſtowed upon its Muſcles. Concerning which Dr. *Willis* thus diſcourſes. "This Member (ſaith he) having only "Nerves from the Spinal marrow, ſhould only "have a ſpontaneous motion according to our "Hypotheſis, (*viz.* that the Nerves from the "Brain ſerve for natural, and the Vertebral for "voluntary motion.) And yet through the turgeſcency of the Genital humour, it is often "erected and filled with Spirit againſt one's

" mind; which is from hence, becauſe from this
" Vertebral pair, whence the Nerves of the *Penis*
" ſpring, a ſprig is reached forth to the Vertebral
" pair next above it, *viz.* to that in which is
" radicated the *Plexus* that is placed in the *Pelvis*
" and beſtows Nerves on the *Proſtatæ*, into which
" *Plexus* alſo a notable Nerve is implanted from
" the Intercoſtal pair. Seeing therefore there is
" a communication between the *Proſtatæ*, (which
" depend much on the Intercoſtal Nerves) and
" the *Penis* it ſelf, (by reaſon of the inſertion of
" the foreſaid ſprig into the *Plexus* from whence
" the *Proſtatæ* have their Nerves:) hence it
" comes to paſs that it acts accordingly as they
" are affected. But they (*viz.* the *Proſtates*) are
" not only apt to be moved by the turgeſcency
" of the Seed; but, by the communication of the
" Intercoſtal Nerve, according to the impreſ-
" ſions made on the Senſes or Brain, are wont to
" be irritated by too importune an action; into
" conſent wherewith the *Penis* is preſently ex-
" cited.

Uſe. Its principal *uſe* is to convey the Seed into the *Uterus* of the Female; and its uſe to piſs withal, is but ſecondary, for many Creatures (as Fowls in general) make no water by it, yet have a *Penis* for the uſe aboveſaid.

Pubes *and* Inguina. That part that is next above it towards the Belly, is called the *Pubes*; and its lateral parts are called *Inguina*, the Groins.

Tab. VIII.

Fig. I. ſhews the *Vaſa deferentia*, Seed-bladders, and Proſtates.

AA *Parts of the* Vaſa deferentia, *which appear thick, but have only a ſmall Cavity.*

BB *The parts of the* Vaſa deferentia *of a thin ſubſtance and large Cavity, being widened.*

CC *The extremities of the* Vaſa deferentia *narrowed again, and gaping each with a little hole into the neck of the Seed-bladders.*

DD *The neck of the Seed-bladders parted from each other by a Membrane going between, ſo that the Seed of one ſide cannot be mixed with that of the other, before it come to the* Urethra.

EE *The* Veſiculæ ſeminales, *or Seed-bladders blown up, that their wonderful widenings and narrowings may be ſeen.*

FF *Veſſels tending to the Seed-bladders.*

GGG *The Membranes whereby the Seed-bladders and* Vaſa deferentia *are kept in their places.*

HH *The Sanguinary veſſels running by the ſides of the* Vaſa deferentia.

I *A Caruncle reſembling a Snipe's head, through whoſe eyes as it were the Seed iſſues out into the* Urethra.

KK *The Ducts of the* Corpus glandoſum, *or* Proſtatæ *opening into the* Urethra *by the ſides of the Caruncle.*

LL *The* Corpus glandoſum *divided.*

MM *The* Urethra *opened.*

Tab. VIII.

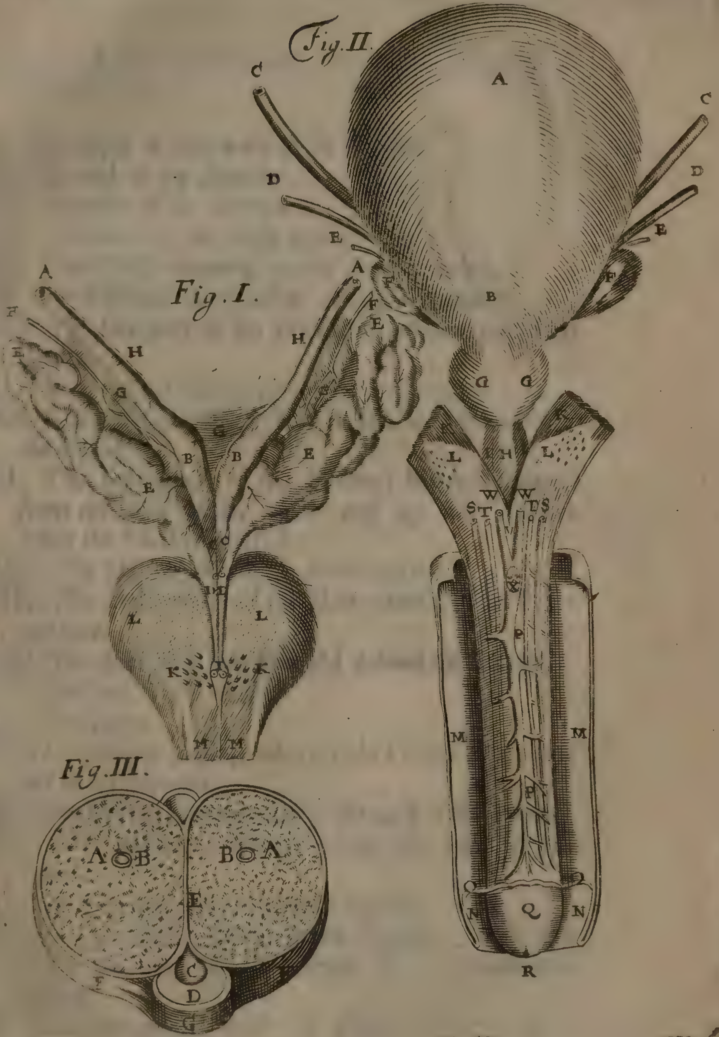


Fig. II.
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Fig. I.
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Fig. III.
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Fig. II. ſhews the Bladder, *&c.* the *Penis* and its Veſſels, *&c.*

A *The upper or fore-part of the Bladder.*
B *The neck of the Bladder.*
CC *Portions of the* Ureters.
DD *Portions of the* Vaſa deferentia.
EE *The Veſſels running to the Seed-bladders.*
FF *The* Veſiculæ ſeminales, *or Seed-bladders.*
GG *The fore-part of the* Proſtatæ, *or* Corpus glandoſum.
H *The* Urethra *adjoyning to its ſpongy part.*
KK *The Muſcles called the Erectors or Extenders of the* Penis.
LL *The beginnings of the Nervous bodies ſeparated from the* Oſſa pubis, *which puff up like Bellows when the Yard is erected.*
MM *The Skin of the* Penis *drawn aſide.*
NN *The duplicature of the Skin making the* Præputium.
OO *The Skin that was faſten'd behind the* Glans.
PP *The back of the* Penis.
Q *The* Glans.
R *The urinary paſſage whereby the* Glans *is perforated in its fore-part.*
SS *The Nerves running along the back of the* Penis.
TT *The Arteries running along the back of the* Penis.
U *The Nervous bodies meeting together.*
WW *Two Veins which unite together, and run along the back of the* Penis *in a remarkable branch.*
X *The Vein opened, that the Valves in it may be ſeen.*

Fig. III. ſhews the *Penis* cut aſunder tranſverſly.

AA *The ſpongy or fibrous ſubſtance of the Nervous bodies.*
bb *The two Arteries that march along the Nervous bodies.*
C *The urinary paſſage of the* Urethra.
D *The ſpongy ſubſtance of the* Urethra.
E *The* Septum *between the two Nervous bodies.*
FF *A very ſtrong Membrane of the Nervous bodies.*
G *A very thin Membrane containing the ſpongy ſubſtance of the* Urethra.
H *A notable Vein creeping along the back of the* Penis.

Of the GENITALS *in Women.*

CHAP. XXIV.

Of the Vaſa præparantia.

HAving now done with the Parts miniſtring to Generation in *Men*, we next proceed to thoſe of *Women*; in deſcribing of which it has been the method of divers Anatomiſts to begin firſt with the outer parts of the Privity: but becauſe we would obſerve, as much as may be, the ſame order in Women as we have in Men, we ſhall firſt begin with the Spermatick veſſels, which are of two ſorts, *Arteries* and *Veins*.

Spermatick Arteries. The *Arteries* are two, as in Men. They ſpring from the great Artery a little below the Emulgents (very rarely either of them from the Emulgent it ſelf) and paſs down towards the *Teſtes* not by ſuch a direct courſe as in Men, but with much twirling and winding amongſt the Veins, with which yet they have no inoſculation, as has been generally taught. But for all their winding, when they are ſtretch'd out to their full length, they are not ſo long as thoſe of Men; becauſe in them they deſcend out of the *Abdomen* into the *Scrotum*, but in Women they have a far ſhorter paſſage, reaching only to the *Teſtes* and Womb within the *Abdomen.*

The *Veins* are alſo two, ariſing, as in Men, the right from the Trunk of the *Cava* a little below the Emulgent, the left from the Emulgent it ſelf. In their deſcent they have no more windings than in Men, and therefore are conſiderably ſhorter. *Veins.*

Both the *Arteries* and *Veins* as they paſs down are cover'd with one common Coat from the *Peritonæum*; and near the *Teſtes* they are divided into two branches, the upper whereof is implanted into the Teſticle by a triple root; and the other is ſubdivided below the *Teſtes* into three twigs, one of which goes to the bottom of the Womb, another to the *Tuba* and round Ligament, the third creeping by the ſides of the Womb under its common Membrane, ends in its neck, where it is interwoven with the Hypogaſtrick veſſels like a Net. By this way it is that the *Menſtrua* ſometimes flow in Women with Child for the firſt months, and not out of the inner Cavity of the *Uterus*: but yet that blood does not flow at that time ſo much by the Spermatick Arteries as by the Hypogaſtrick.

Their uſe. The *uſe* of theſe Spermatick veſſels is to miniſter to the (generation of Seed, according to the ancient doctrine; but) nutrition of the Eggs in the *Ovaria* or *Teſtes* (according to the new) the nouriſhment of the *Fœtus*, and of the Womb it ſelf, and the expurgation of the *Menſes*; inaſmuch as blood is conveyed by the Arteries to all thoſe parts to which their ramifications come, in which parts they leave what is to be ſeparated according to the Law of Nature, the remaining blood returning by the Veins.

CHAP. XXV.

Of Womens Teſticles or Ovaria.

Womens Teſtes. WOmen's *Teſticles* differ much from Men's both in their ſituation, figure, greatneſs, coverings, ſubſtance, and alſo uſe.

Their ſituation. Firſt, their *ſituation* is not without the Body, as in Men, but in the inner Cavity of the *Abdomen*, on each ſide two Fingers breadth diſtance from the bottom of the Womb, to whoſe ſides however they are knit by the intervention of a ſtrong Ligament, that has us'd to be called and accounted the *Vas deferens*; as if the Seed were carried by it from the *Teſtes* to the Womb. Of which afterwards.

Figure. They are flat on the ſides; in their lower part oval, but in their upper (where the Blood-veſſels enter them) more plane. Their ſuperficies is more rugged and unequal than in thoſe of

Men. They have no *Epididymides*, nor *Cremaſter* Muſcles.

Greatneſs. They differ in *bigneſs* according to age. In thoſe newly come to maturity they are about half as big as thoſe of Men; but in thoſe in years they are leſs and harder. Preternaturally they ſometimes grow to a vaſt bigneſs from Hydropical tumours, in which ſeveral quarts of ſerous liquor have been found to be contain'd.

Tunicle. They have but one *Membrane* that encompaſſes them round; but on their upper ſide, where the *Vaſa præparantia* enter them, they are about half way involved in another Membrane that accompanies theſe Veſſels, and ſprings from the *Peritonæum.*

Subſtance. When this cover is removed, their *ſubſtance* appears whitiſh, but is wholly different from the ſubſtance of Men's Teſticles. For Men's (as was ſaid above) are compoſed of Seminary veſſels, which being continued to one another are twenty or thirty Ells long, if one could draw them out at length without breaking: But Women's do principally conſiſt of a great many Membranes and ſmall Fibres looſely united to one another; amongſt which (in the outer ſuperficies of the *Teſtes*) there are ſeveral little Bladders (like to *Hydatides*) full of a clear liquor, through whoſe Membranes the Nerves and *Vaſa præparantia* run, and are obliterated in them.

Whether they elaborate Seed. The liquor contained in theſe Bladders had always been ſuppoſed by the followers of *Hippocrates* and *Galen*, to be Seed ſtored up in them, as if they ſupplied the place of the *Veſiculæ ſeminales* in Men. But from Dr. *Harvey* downwards, many learned Phyſicians and Anatomiſts (according to *Ariſtotle*) have denied all Seed to Women.

Of which the ſaid Dr. *Harvey* thus diſcourſes, *De ovi materia, Exercit.* 34. “ Some Women “ emit no ſuch humour as is called Seed, and yet “ is not conception thereby neceſſarily fruſtrated; “ for I have known ſeveral Women (ſays he) “ that have been fruitful enough without ſuch emiſſion; “ yea, ſome that after they begun to “ emit ſuch humour, though indeed they took “ greater pleaſure in copulation, yet grew leſs “ fruitful than before. There are alſo infinite “ Inſtances of Women, who though they have “ pleaſure *in coitu*, yet ſend forth nothing, and “ notwithſtanding conceive. *Miror maxime*, adds he, *eos, qui emiſſionem hanc ad generationem neceſſariam putant, non animadvertiſſe, humorem illum foras ejici, & circa clitoridem vulvæque orificium utplurimum profundi, raro intra vulvam, nunquam vero intra uterum, ut cum maris ſpermate miſceatur; eſſeque conſiſtentia ſeroſum ſive ichoroſum, ad modum urinæ; non autem genituræ inſtar, lentum atque unctuoſum; ut tactu facile innoteſcit. Quorſum autem foras ejiciatur, cujus uſus neceſſario intus requiritur? Debuitne humor ille, ceu utero valedicturus, ad limen vulvæ amandari; ut majore cum gratia ab utero retraheretur denuo?*] So that both from the place of its emiſſion, and from its conſiſtence, he concludes that the humour emitted cannot be Seed. To ſtrengthen which Opinion two Reaſons may be added, why it cannot be the humour contained in theſe *Veſiculæ*, and conſequently that it cannot be Seed; firſt becauſe it is ſent forth in greater quantity than that it can be ſupplied from them; and ſecondly becauſe the *Veſiculæ* are deſtitute of any ſuch pore or paſſage whereby the liquor contained in them might iſſue out; for if you preſs them never ſo hard, unleſs you burſt them, there will nothing paſs out of them.

They are Ovaries.

We muſt therefore ſubſcribe to that new but neceſſary opinion that ſuppoſes theſe little Bladders to contain nothing of Seed, but that they are truly Eggs, analogous to thoſe of Fowl and other Creatures; and that the Teſticles (ſo called) are not truly ſo, nor have any ſuch office as thoſe of Men, but are indeed an *Ovarium* wherein theſe Eggs are nouriſhed by the Sanguinary Veſſels diſperſed through them, and from whence one or more (as they are fecundated by the Man's Seed) ſeparate and are conveyed into the Womb by the *Tubæ Fallopianæ*, of which by and by.

That theſe *Veſiculæ* are analogous to the little Eggs in the *Ovarium* of Fowl, *de Graef* evinces by this Experiment, That if you boil them, their liquor will have the ſame colour, taſte, and conſiſtency with the White of Birds Eggs. And their difference in wanting Shells is of no moment; for even the Eggs of Fowls while they are in the Ovary (yea after they have deſcended into the *Uterus*) have no Shell: and though when they are laid, they have one, yet that is nothing eſſential to them, but only a fence that Nature has provided (upon their excluſion) to preſerve them from external injuries while they are hatched without the body; whereas theſe of Women being foſtered within their body, have no need of other fence than the Womb, by which they are ſufficiently defended.

Having compared theſe *Veſiculæ* to the Eggs of Fowls, I might here follow the method of Doctor *Harvey* and *de Graef*, and deſcribe the *Ovarium*, &c. in Hens, &c. that from thence theſe in

Women

Women might the better be conceived of and apprehended; but to the curious and learned Reader I ſhall recommend the ſaid Authors for ſatisfaction, and avoiding all unneceſſary and (to this Epitome) unſuitable excurſion, I ſhall only further note two things: Firſt, that theſe Eggs in Women are commonly towards the number of twenty in each Teſticle or *Ovarium*, of which ſome are far leſs than others. And ſecondly, that the Objection of the *Galeniſts* againſt the *Ariſtotelians*, (*viz.* that the *Teſtes* of Females muſt needs make Seed, becauſe when they were cut out, barrenneſs always follow'd) will be ſufficiently obviated by this new *Hypotheſis*, that agrees to the neceſſity of the Teſticles ſo far as to affirm that the *Veſiculæ* contained in them become (when they are impregnated by the Maſculine Seed) the very Conceptions themſelves, which therefore it would be in vain to expect if the Female were caſtrated.

Beſides the *Vaſa præparantia*, and *Nerves* (of which laſt in the 27*th* Chapter) they have alſo *Lympheducts*, according to Dr. *Wharton*.

CHAP. XXVI.

Of the Vaſa deferentia *in Women, or their Oviducts.*

GAlen with moſt of the Ancients reckoned thoſe ſhort proceſſes that go ſtreight from the *Teſtes* to the bottom of the Womb, to be *Vaſa deferentia*; and that the Seed was emitted from the *Teſtes* through them into the *Fundus uteri*. And

Fernelius, *Riolanus*, *&c.* thought they found a ſmall Pipe paſſing on each ſide out of theſe proceſſes by the ſides of the Womb to its neck, into which they were inſerted and opened near its Orifice. By the former it was ſuppoſed Women not with Child did emit their Seed into the bottom of the Womb, and by theſe latter ſuch as were already impregnated: for that, if it ſhould have iſſued into the *Fundus* where the Conception was, it would there have corrupted to the great prejudice of the *Fœtus.*

But as to theſe latter Ducts, *Veſlingius*, *Diemerbroeck*, *de Graef*, and many other accurate Anatomiſts, have not been able to find the leaſt footſtep of them. And as for the former, ſeeing they are not pervious, nor have any Cavity, (and therefore can neither contain nor convey any thing of Seed) we muſt conclude with *de Graef*, that they are only Ligaments of the Teſticles to keep them in their place; which he evinces further by obſerving that they come not to the inner Cavity of the *Uterus*, but are knit only to its outer Coat: for he ſays, there are only two holes in the *Fundus uteri* that admit a Probe, and thoſe lead to the *Tubæ Fallopianæ* and not to theſe Ligaments.

Tubæ Fallopianæ.

Seeing therefore that thoſe which have been accounted *Vaſa deferentia* either are not to be found at all, or are found uncapable of ſuch an office; and having withal rejected the opinion of Women's having Seed, and affirmed that that which makes the conception is one of thoſe *Veſiculæ* in the *Teſtes*, dropping from thence and conveyed into the Womb, we muſt enquire by what way theſe can paſs. For if the abovesaid Ligaments (reputed *Vaſa deferentia*) have no paſſage whereby by even the *Semen*, if there were any, might be conducted ; much leſs could one of theſe *Veſiculæ* be conveyed that way. And therefore for *Vaſa deferentia* we aſſign thoſe Ducts, that *Fallopius* in his Anatomical Obſervations calls *Tubæ*, and deſcribes thus : “ They are very ſlender and nar- “ row Ducts, nervous and white, ariſing from the “ horns (or ſides) of the Womb, and at a little “ diſtance from it they become larger, and twiſt “ like the tendrel of a Vine, till near their end, “ where ceaſing their winding they grow very “ large , and ſeem membranous , and carnous “ from their red colour. Which end is very much “ torn and jagged like the edge of rent Cloths : “ and has a large Foramen, which (ſays he) al- “ ways lies cloſed, becauſe thoſe jags fall toge- “ ther ; but yet being opened carefully, they are “ like the utmoſt Orifice of a Braſs Trumpet.” But *de Graef* ſays, though they grow very large towards their end, yet of a ſudden the very extream part is narrowed before it is divided into the aforeſaid jags, which he reſembles unto leaves. Who alſo appeals unto Experiment for theſe *Tubæ*'s being pervious, affirming that if one put a little Tube into the beginning of one of theſe ſame Trumpets and blow it, the wind will preſently break through it, which he ſaith he has obſerved in all the kinds of Animals that he has diſſected.

“ Theſe *Tubæ* (according to Dr. *Harvey*) are “ the ſame in Women that the *Cornua* or Horns “ of the Womb are in other Creatures. For they “ anſwer to thoſe both in ſituation, connexion, “ amplitude, perforation, likeneſs, and alſo office : “ for as other Animals always conceive in the “ *Cornua*, ſo it has been ſometimes obſerved (as by *Riolanus* from others; and by Dr. *Harvey* himſelf) "that a conception has in a Woman "been contained in one of the *Tubæ*.] Which muſt have happened, when the *Ovum* being received out of the *Teſtis* into it, has been ſtopt in its paſſage to the Womb, either from its own bigneſs, or ſome obſtruction in the *Tuba*.

Their ſubſtance. Their *ſubſtance* is not nervous (as *Fallopius* in the above-recited deſcription affirms) but membranous. For they conſiſt of two *Membranes*, the *outer* and *inner*. The *inner* ſprings from (or at leaſt is common with) the inmoſt Membrane of the Womb; but whereas it is ſmooth in the Womb, it is very wrinkled in the *Tubæ*. The *outer* is common with the outmoſt of the Womb; and this is ſmooth.

Width. The *capacity* of theſe Ducts varies very much; for in the beginning as it goes out of the Womb, it only admits a briſtle, but in its progreſs where it is largeſt, it will receive ones little Finger. But in the outmoſt extremity where 'tis divided into jags, it is but about a quarter ſo wide.

Length. They are very uncertain alſo in their *length*; for from four or five, they ſometimes encreaſe to eight or nine Fingers breadth along.

Uſe. Their *uſe* is, in a fruitful copulation to grant a paſſage to a more ſubtile part of the Maſculine ſeed (or to a ſeminal air) towards the *Teſtes*, to bedew the Eggs contained in them; which Eggs (one or more) being by that means fecundated (or ripened as it were) and dropping off from the *Teſtis* (in the manner as ſhall be deſcribed Chap. 30.) are received by the extremity of the *Tubæ*, and carried along their inner Cavity to the *Uterus*. For Dr. *Harvey* affirms, that they have a worm-like or periſtaltick motion like that of the Guts, (*de Cervarum & Damarum Utero, Exercit.* 65.) And the ſame is affirmed by *Swammerdam, Not. in Prodr.*

Objections againſt their uſe anſwered.

Againſt this *Uſe* two *Objections* may be made; Firſt, that the end of the *Tuba* not adhering cloſe to the *Teſtis*, when one of the *Veſiculæ*, (or *Ova* as we think they are) ſhall drop off from the *Teſtis*, it would more probably fall into the Cavity of the *Abdomen*, than light juſt pat in the mouth of the *Tuba*. Secondly, that when it is received by it, its Duct is ſo narrow, that 'tis hard to conceive how it can paſs by it.

As to the *firſt*; the ſame Objection may lie againſt the uſe of the Oviduct or *Infundibulum* in Hens, for neither in them does it joyn quite cloſe to the *Ovarium*, (as *Swammerdam*, &c. truly obſerves) and yet it is certain that the *Vitelli* or little Yelks (or rudiments of the Eggs) do all paſs by them to the *Uterus*. The ſame, *Swammerdam* obſerves alſo in Frogs, in one of whom there are many hundreds of Eggs, which all paſs one after another from the *Ovarium* by the Oviduct or *Infundibulum*, and yet the mouth of the Oviduct is almoſt two Fingers breadth from the *Ovarium*, and beſides is immoveable, whereas the *Tubæ* in Women are at liberty (and are more than long enough) to embrace the *Ovarium* with their Orifice: and we may reaſonably believe that they do ſo when a conception is made; for it is not improbable that when all the other parts of the Genital are turgid in the act of Copulation, theſe *Tubæ* alſo may be in ſome meaſure erected, and extend their opened mouth to the Teſticle, to impregnate the *Ova* with the Seminal air ſteaming through their Duct, and if any one be fecundated and ſeparate, to receive it afterwards by its Orifice.

As to the *ſecond Objection*, which urges the narrowneſs of theſe *Tubæ*; He that conſiders the ſtraitneſs of the inner Orifice of the Womb, both in Maids, and Women with Child, and yet obſerves it to dilate ſo much upon occaſion as to permit an egreſs to the Child out of the Womb, cannot wonder that to ſerve a neceſſary end of Nature the ſmall duct of the *Tubæ* ſhould be ſo far widen'd as to give paſſage to an *Ovum*, ſeeing its proportion to their duct is many times leſs than of the Child to the uſual largeneſs of the ſaid Orifice.

CHAP. XXVII.

Of the Uterus *or Womb, and its Neck.*

HAving treated of the *Vaſa præparantia* (ſo called) that bring nouriſhment to the *Teſtes* or *Ovaria*, as alſo of theſe and their *Ova*, and laſtly of the *Tubæ* through which the *Ova* paſs to the *Uterus*; we now come to the *Uterus* it ſelf which receives the *Ova*, and in which the conception is formed, and the *Fœtus* nouriſhed till it acquire its due maturity and be fit for the birth.

The *Uterus* or Womb is uſually divided into four parts, the *Fundus* or bottom, *Os internum* or *Cervix*, the *Vagina*, and the *Sinus pudoris* or outward Privity. Of each of theſe in order. And firſt of the *Fundus*. *The Womb.*

This in a ſpecial manner is called the Womb, becauſe all the reſt ſeem to be made for its ſake. It is alſo called the *Matrix*, from its being as a *Its name.*

Mother to conſerve and nouriſh the *Fœtus*; and likewiſe *Utriculus* from its ſhape reſembling a *Bottle*.

Situation. It is ſeated in the *Hypogaſtrium* or loweſt part of the *Abdomen*, in the middle of that large hollow that is called *Pelvis*, and is formed by the *Oſſa ilii*, *coxæ*, the *Oſſa pubis*, and the *Os ſacrum*. In this Cavity is placed between the Bladder and the ſtreight Gut; ſo that Man being bred betwixt Piſs and Dung, if he would but conſider his Origine, might hence draw an Argument of humility.

Connexion. Its hindmoſt part is looſe, that it might be extended as the *Fœtus* encreaſeth. But its ſides are tied faſt by two pairs of *Ligaments*.

Ligaments. The *firſt pair* are further from the *Os internum*, and are broad, ariſing from the *Peritonæum*. They have a membranous, looſe, and ſoft ſubſtance, and for their ſhape are reſembled to Bats wings. They tie the ſides of the *Fundus*, the *Teſtes*, and a good part of the *Tubæ* together, and are faſten'd to the *Oſſa ilii*, whereby the Womb is kept from falling down upon its Neck. But if they be either immoderately relaxed, or by any violence broken, then the Womb deſcends and ſometimes falls out (turning inſide outwards) if the ſubſtance of the Womb happen to be relaxed alſo.

The *ſecond pair* ariſe nearer to the inner Orifice of the *Vagina*, about where the *Tubæ* do, and are called the round Ligaments, or worm-like. From their origine which is broad, they aſcend on each ſide between the duplicature of the *Peritonæum* toward the Groins, and running out of the Cavity of the *Abdomen* become round, and then paſs obliquely above the *Os pubis* towards the fat of *Mons Veneris* in which they terminate near the *Clitoris*, being divided into many parts or jags, as may be ſeen in the following Figure. They conſiſt of a double Membrane, the inner whereof has all ſorts of Veſſels, Nerves, Arteries, Veins, and *Vaſa Lymphatica*; and are about a ſpan long. *Veſlingius*, *Diemerbroeck*, &c. ſay that they receive a ſmall Seminal veſſel from the *Teſtes* and *Tubæ*, which they conduct to the *Clitoris* into which they are inſerted, and ought rather to be accounted *Vaſa deferentia* than Ligaments. So that what ſome Women emit from about the *Clitoris* in coition they think to be true *Semen* conducted hither by thoſe ſeminal ducts. But *de Graef* denies any ſuch ducts, and affirms that theſe Ligaments reach not the *Clitoris*, but are terminated in the aforeſaid fat. And that humour which Women emit (ſometimes) he thinks doth iſſue out of the *Lacunæ* in the Orifices of the *Vagina* and urinary paſſage, or alſo from the *Meatus*'s in the Neck of the Womb: which humour is ſupplied to the former parts from the thick and membranous body that is about the urinary paſſage; and to the latter from the nervoſe-membranous ſubſtance of the neck of the Womb: but he thinks it does not partake of the nature of Seed, but ſerves only for the lubricating of the *Vagina* to cauſe the greater pleaſure *in coitu.* But to this purpoſe more before.

Subſtance.

Its *ſubſtance* is whitiſh, nervous or rather membranous; denſe and compact in Virgins, but in Women with Child a little ſpongy and ſoft.

Membranes

It is compoſed of three *Membranes.* The *outmoſt*, (which is common to it with all the *Viſcera* in the *Abdomen*, as being derived from the *Peritonæum*) is very fibrous, compact, and tough, without any diſcernible Vein or Artery. The *middle* is much thicker, and endued with carnous Fibres, and is full of Blood-veſſels, very remarkable at all times, but eſpecially in the flux of the *Menſes*, or in the time of geſtation. During this latter time, this Coat (with the *inmoſt*) imbibes ſo much of the nutritious humours that then flow hither, that the more the *Fœtus* encreaſeth, and conſequently the more diſtended the Womb, the more fleſhy and thick doth it grow. And yet (which is ſtrange) within ſixteen or twenty days after a Woman is brought to Bed, it becomes as thin as before, and the whole Womb contracts into ſo little a compaſs as to be held in ones hand.

The *inmoſt* likewiſe abounds with Blood-veſſels propagated into it from the middle one, and is full of pores by which the blood in the menſtrual flux is extravaſated out of the Arteries into the Womb, and upon impregnation the *Succus nutritius* exſudes into the ſame, and by which alſo, both blood and chyle are conveyed into the *placenta uterina* after the formation thereof.

Bigneſs. In Virgins it is about two Fingers breadth broad, and three long. In thoſe that have lain with a Man it is a little bigger, and ſomething larger yet in thoſe that have born Children.

Figure. In *ſhape* it is ſomething like a Pear, only a little flattiſh above and below. But in Women with Child it becomes more round.

Cavity. In Maids its *Cavity* is ſo ſmall that it will hardly hold a large Hazel-nut. In thoſe that have had Children it will hold a ſmall Walnut. It is divided into no Cells as it is in moſt viviparous Brutes, but only into the right and left ſide by a

Suture or line that goes lengthways, much like that on the outſide of the *Scrotum* in Man. Its Cavity is not quite round, but jets out a little towards each ſide; which jetting ſome call its Horns, but improperly: for though *Galen* (and many after him) having never diſſected any Woman, preſuming that their Womb was like that of other viviparous Creatures, attributed *Cornua* thereto, yet in truth they have none; but the *Tubæ Fallopianæ* (as was noted before) anſwer to them in many reſpects. Only in Brutes (*viz.* ſuch as have *Cornua*) the conception is always formed in the *Cornua*, as being the greateſt part of the *Uterus*, (which from the very Orifice of its *Fundus* is preſently divided into them, as when one parts the fore from the middle Finger as wide as one can) but very rarely in the *Tubæ* in Women, but moſt an end in the *Fundus* it ſelf. Of which more in Chap.30.

Arteries.

Its *Arteries* ſpring partly from the Spermatick or *Præparantes*, and partly from the Hypogaſtrick. Theſe two Arteries do on each ſide by a notable branch inoſculate one with the other. And both their branches that run on one ſide the Womb, do inoſculate with thoſe of their own ſtock on the other. Which may plainly be ſeen by blowing into the Trunk of either of them on which ſide you will, for then the branches on the other ſide will be puffed up, as well as thoſe on that ſide you blow.

They run along the Womb not with a ſtreight or direct courſe, but bending and winding, that they may be extended without danger of breaking when the Womb is enlarged to ſo great a bulk by the *Fœtus*. By theſe Arteries it is that the *Menſes* flow, in greateſt quantity out of thoſe that open into the *Uterus* it ſelf, but in leſſer out of thoſe branches that reach and open into the *Cervix* or neck of the Womb, and in leaſt (if at all) out of the *Vagina.*

As to the reaſon of the menſtrual flux, 'tis not likely that the redundance of blood is the ſole cauſe of it; for then would the term of the flux come ſooner or later accordingly as the Diet ſhould be more full, or more ſparing. Whereas experience ſhews, that let a Woman feed never ſo high, and ſo breed never ſo much blood, this flux comes never the ſooner, (though perhaps it may be larger;) or let her uſe the moſt ſpare diet, and (if ſhe be healthful) it will be never the longer a coming. Wherefore beſides a ſufficient ſtock of blood there ſeems requiſite alſo a fermentation therein, to the producing this flux. Which fermentation by what it ſhould be cauſed, is hard to determine. Thoſe who grant Seed to Women, derive it thence, becauſe as ſoon as Girls come to puberty, and deſire and become fit for coition, the *menſes* begin to flow. But concluding, according to the Moderns, that women have no Seed, the ſame can be no cauſe hereof. Aſtrological reaſons I account vain, ſeeing there are menſtruous women at all ſeaſons; and the ſame women have their *menſes*, in proceſs of time, at all ages of the Moon. Other reaſons may by the Curious be offered, but all thoſe I have met with are unſatisfying. Waving them therefore, but ſuppoſing a fermentation in the blood to be the principal cauſe, we ſhall only add a word of the immediate reaſon or manner of the Flux, when through this fermentation the blood flows ſo plentifully into the Uterine Arteries, that the Veins (which are fewer than the Arteries) cannot return it all back again by the circulation, it burſts forth of the extremities of the Arteries ſo long, till the too great quantity of the blood be leſſen'd and the fermentation ceaſes, which it does ordinarily after three or four days, and ſo the flux ſtops till the next period. In Women with Child they ſeldom flow, either becauſe the redundant blood is then beſtowed on the nouriſhment of the *Fœtus*, according to the old Hypotheſis; or according to the new, becauſe it is defrauded of a conſiderable part of the Chyle (or nutritious juice) which is conſumed by the *Fœtus*, whereby it becomes diminiſhed and depauperated, which is the reaſon why Nurſes alſo ſeldom have them.

Veins. The *Veins* do likewiſe ſpring from the *Præparantes*, and from the Hypogaſtrick. There are many anaſtomoſes of theſe Veins one with another, (as there was noted of the Arteries) but eſpecially in the ſides of the *Uterus*, which do more readily appear by blowing of them up, than thoſe of the Arteries above ſpoken of. The blood brought hither by the Arteries, that is not ſpent on the ordinary nutrition of the Womb, or is not caſt out when the *menſes* flow, returns by theſe Veins back to the Heart.

Nerves. It has *Nerves* from the *Plexus meſenterii maximus* of the Intercoſtal pair, and from the loweſt *Plexus* of the ſame. As alſo from the Nerves of *Os ſacrum*. And the ſame run alſo to the *Teſtes* or *Ovaria*. Now it is theſe *Plexus* of Nerves that are chiefly affected in the Hyſterical paſſion, or Fits of the Mother. For theſe Fits are merely Convulſive, and often happen without any fault of the Womb at all. And that ſymptom that in

ſuch

ſuch Fits is uſual, namely when ſomething like a Ball ſeems to riſe from the bottom of the Belly and to beat ſtrongly about the Navel (which is uſually taken by women for the riſing of the Womb or Mother) is nothing but the Convulſion of theſe *Plexus* of Nerves: which one will the rather believe, when he conſiders that ſome men are afflicted with the ſame ſymptom. Of which ſee more in Dr. *Willis* (*in Cerebr. anat. p.* 201.) who derives the pain of the Colick alſo from the ſame cauſe.

Lymphe-ducts. *De Graef* ſays there are many *Lympheducts* that creep through the outer ſubſtance of the *Uterus*, which one after another meeting into one, empty themſelves into the common Receptacle: And theſe, he ſays, *Bartholin* miſtakes for *Venæ lacteæ*.

Uſe. The *uſe* of the Womb is to receive into its capacity the principles of the formation of the *Fœtus*, to afford it nouriſhment, to preſerve it from injuries, and at length when it is grown to maturity and requires the light and a freer air, to expel it forth.

The neck of the Womb. The *Cervix* or *Os internum* of the Womb being continuous to it and coming betwixt it and the *Vagina*, we will treat of it in this Chapter. It ſeems to be a part of the *Fundus* or of the Womb properly ſo called, only it is much narrower, for its Cavity is no wider in Virgins than a ſmall Quill, and in women with Child its inner Orifice doth either quite cloſe its ſides together, or is daub'd up with a ſlimy yellowiſh humour, ſo that nothing can then enter into the Womb, unleſs in very luſtful women it be ſometimes open'd in ſuperfœtation. It is an Inch or more in length.

Its Cavity as it opens to the *Vagina* is compared to the mouth of a Tench; *Galen* likens its paſſage to that in the *Glans* of a Man's *Penis*; for it is not round, but long and tranſverſe. It is wrinkled, and has many ſmall ducts opening into it, out of which one may preſs a pituitous ſerous matter. It has the ſame Membranes and the ſame Veſſels with the *Uterus* it ſelf. *De Graef* ſays that amongſt its wrinkles he has often obſerved *Hydatides* or little watry Bladders; and thinks, that the aboveſaid ſerous matter ſerves only to moiſten the *Vagina*, &c. and to excite to Venery.

CHAP. XXVIII.

Of the Vagina, *and its Contents*, viz. *the* Hymen *and* Carunculæ myrtiformes.

Continuous unto the *Cervix* is the *Vagina*, ſo called, becauſe it receives the *Penis* like a *Sheath*. It is called alſo the *door of the Womb*, and its *greater Neck*, to diſtinguiſh it from the leſſer juſt now deſcribed in the foregoing Chapter. Vagina. *Its name.*

It is a ſoft and looſe Pipe, uneven on its inſide with orbicular wrinkles, of a nervous but ſomewhat ſpongy ſubſtance (which luſt cauſeth to puff up a little, that it may embrace the Yard more cloſely) about ſeven Fingers breadth long, and as wide as the ſtreight Gut: all which yet, both length, width, and looſeneſs differ in reſpect of age, *&c.* and as a woman is inflam'd more or leſs with luſt. So alſo the aforeſaid wrinkles are much more numerous and cloſe ſet in Virgins, *Deſcription.*

and

and in women that ſeldom accompany with a man, and that have never born Children, than in thoſe that have born many Children, and in Whores that uſe frequent copulation, or thoſe that have long laboured under the *fluor albus*, for in all theſe three ſorts they are almoſt obliterated. Its thickneſs on the upper ſide, (according to *de Graef*) is about a ſtraws breadth; but on its lower it is twice as thick. *Stockhamer* ſays, it conſiſts of a ſpongy and glandulous ſubſtance, through which not only plentiful branches of Veins and Arteries, (*viz.* from the hypogaſtrick and hemorrhoidal) are diſperſed, as alſo Nerves from the *Os ſacrum*; but it has alſo proper excretory Ducts, which gape like pores into its inner cavity, and are moſt numerous near the urinary paſſage. And this ſubſtance, he ſays, is contained between two Membranes, of which the inner is nervous and wrinkled; the outer, carnous.

Veſſels. It has very many *Arteries* and *Veins*, ſome of which inoſculate one with another, and others not: By the Arteries that open into it do the *Menſes* ſometimes flow in Women with Child that are plethorick: for they cannot come from the Womb it ſelf, unleſs abortion follow, as ſometimes it does. Theſe Veſſels bring plenty of blood hither in the venereal congreſs, which heating and puffing up the *Vagina* encreaſeth the pleaſure, and hinders the Man's Seed from cooling before it reach the *Uterus*. They ſpring not only from the Hypogaſtrick, but alſo from the Hemorrhoidal, but theſe latter run only through the lower part of the *Vagina*. Its Nerves Dr. *Willis* thus deſcribes: From the loweſt *plexus* of the *Abdomen* two Nerves are ſent into the *Pelvis*, where each receives a notable vertebral Nerve; and ſo they make two *plexus*, one on each ſide: from which there ariſe two aſcending Nerves that run to the *Inteſtinum rectum*, and two deſcending that are carried to this part we are ſpeaking of.

Glands.

Caſp. Bartholin relates that in a Cows *vulva* he was ſhewn by *Joſ. du Verney*, a *Gland* on each ſide of it, ſomewhat on the hinder part, each of which has a duct running from it opening into the *vulva*, but at its Orifice has a notable *papilla* placed which cloſes it, ſo that no liquor can paſs out but by the protuberating and uncloſing of the *papilla in coitu.* He ſays, he has not yet obſerved them in Women, but inclines to believe they are not wanting in them; and thinks that that liquor which is ſometimes emitted by them with pleaſure, iſſues a great part of it from hence. The Glands, he ſays, are of the conglomerate kind, and are inveſted round with peculiar and proper carnous Fibres, which ſeem to ariſe from the Sphincter of the Bladder, as thoſe which incompaſs the *Proſtatæ* in Men do according to the obſervation of *de Graef*: and therefore he thinks theſe Glands in Females are in lieu of the *Proſtatæ* in Men.

The inſertion of the Neck of the Bladder.

Near its outer end, between the *Nymphæ* (of which in the next Chapter) in its fore and upper part it receives the neck of the urinary Bladder encompaſſed with its Sphincter: oppoſite whereto in its hinder or lower part it is ſtrongly knit to the Sphincter of the ſtreight Gut. The urinary paſſage, or *Urethra*, is not above two Fingers breadth long from the neck of the Bladder to its end, and about as thick as a Gooſe-quill.

Hymen. The *Hymen* is a thin nervous Membrane interwoven with carnous Fibres, and endowed with many little Arteries and Veins, ſpread acroſs the duct of the *Vagina*, behind the inſertion of the neck of the Bladder, with a hole in the midſt that will admit the top of ones little Finger, by which the *Menſes* flow. It is otherwiſe called the Zone or Girdle of Chaſtity. Where it is found in this form deſcribed, it is a certain note of Virginity; but upon the firſt congreſs with a Man it is neceſſarily violated, which is uſually accompanied with an effuſion of blood; which blood is called the *Flower of Virginity*; and of this the holy Text makes mention in *Deut.* 22. verſes 13.—21. And when once it is broke, it never cloſes again.

But though this effuſion of blood upon coition from the rupture of this Membrane, (or perhaps of Capillary veſſels in the *Vagina*) be a certain token of Virginity; yet it will not follow on the contrary, that where it is wanting, Virginity is alſo wanting. For the *Hymen* may be corroded by acrimonious fretting humours flowing through it with the *Menſes*; or may be violated by the falling out or inverſion of the *Uterus* or the *Vagina* at leaſt, which ſometimes happens even to Maids; or laſtly, perhaps the indiſcreet and unwary Bride has had her *Menſes* a day or two before, in which caſe both the *Hymen* and the inner wrinkled Membrane of the *Vagina* are ſo flaggy and relaxed, that no ſuch rupture, and by conſequence no ſuch effuſion may happen.

In ſome there naturally wants a *foramen* in the *Hymen*, by which means there being no *exit* for the *Menſes*, ſuch are in great peril of their life if they be not relieved by Surgery, *viz.* by opening it with ſome ſharp Inſtrument.

Caruncu-læ myrti-formes.

Cloſe to the *Hymen* lie the four *Carunculæ myrtiformes*, ſo called from their reſembling Myrtle-berries. The largeſt of them is uppermoſt, ſtanding juſt behind the mouth of the Urinary paſſage which it helps to ſhut. Oppoſite to this in the bottom of the *Vagina*, there is another, and on each ſide one, ſo that they ſtand in a ſquare. But of theſe there is only the firſt in Maids, the other three are not indeed Caruncles, but little knobs made of the angular parts of the broken *Hymen* roll'd into a heap by the wrinkling of the *Vagina*, according to *Riolanus* and *Diemerbroeck*. Theſe three when the *Vagina* is extended in a Woman's labour, loſe their aſperity and become ſmooth, ſo that they diſappear, until it be again contracted to its natural ſtraitneſs.

The Sphincter Muſcle.

De Graef affirms, “ that the *Vagina* near its “ outer Orifice has a Sphincter muſcle almoſt “ three Fingers broad, that upon occaſion con-“ ſtringes or contracts it. Which conſtriction is more particularly deſcribed by *Stockhamer*, who ſays, “ it is performed partly by means of the “ Fibres that run through the outer carnous coat “ of the *Vagina*; and partly by this Sphincter “ Muſcle, and two Net-like *plexus* which in their “ compoſition are like the nervous bodies of the “ *Penis*, or of the *Clitoris*; for they conſiſt of veſ-“ ſels and fibres water'd with black blood, and “ clad with a thin Membrane; they climb on ei-“ ther ſide of the *Vagina* near its outer Orifice, “ and notably help to conſtringe it when they “ are puft up with ſpirituous blood in coition; “ for by their ſwelling they drive the ſides of the

“ *vagina* inwards; which that they may the better do, the Shincter muſcle (aſcending from the Sphincter of the *Anus*) doth outwardly cover theſe *plexus*, that by its conſtriction it may hinder them to ſwell outwardly.

The uſe of the Vagina. Having thus deſcribed the parts of the *Vagina*, its *uſe* is eaſily declared to be, to receive the Man's Yard, being erect, to direct and convey the Seed into the Womb, to ſerve for a Conduit by which the *Menſes* may flow out, and to afford a paſſage to the *Fœtus* in its birth, and to the After-birth.

CHAP. XXIX.

Of the Pudendum muliebre, *or Woman's Privity.*

THE parts that offer themſelves to view without any diduction, are the *Fiſſura magna* or great Chink, with its *Labia* or Lips, the *Mons Veneris* and the Hairs. Theſe parts are called by the general name of *Pudenda*, becauſe when they are bared, they bring *pudor* or ſhame upon a Woman.

Fiſſura. The great *Chink* is called *Cunnus* by *Galen*, *à* κύειν, to conceive; by *Hippocrates*, *Natura*. It is alſo called *Vulva*, *Porcus*, *Concha*, and by many other Names that Fancy has impoſed upon it.

It reaches from the lower ſide of the *Os pubis* to within an Inch of the *Anus*; being by Nature made ſo large, becauſe the outer Skin is not ſo apt to be extended in travail as the membranous *Vagina* and *Collum minus* are. It is leſs and cloſer in Maids than in thoſe that have born Children. Its length makes the *Perinæum* not to be above an Inch long. It has two Lips, which towards the *Pubes* grow thicker and more full or protuberant, and meeting upon the middle of the *Os pubis* make that riſing that is called *Mons Veneris*, or the Hill of *Venus*.

Mons Veneris.

The inner ſubſtance of this Hill, which makes it bunch ſo up, is moſt of it fat; and under the fat lies that Sphincter muſcle that we ſpoke of in the laſt Chapter, that conſtringes the Orifice of the *Vagina*, and ſprings from the *Sphincter ani*.

By a little drawing aſide the *Labia*, there then appear the *Nymphæ* and the *Clitoris*.

Nymphæ.

The *Nymphs* are ſo called becauſe they ſtand next to the Urine as it ſpouts out from the Bladder, and keep it from wetting the *Labia*. They are called alſo πτερύγια or Wings. They are placed on each ſide next within the *Labia*, and are two carnous and ſoft productions, beginning at the joynting of the *Oſſa pubis* or upper part of the Privity, (where they are joyned in an acute angle, and make that wrinkled membranous production that clothes the *Clitoris* like a *Præputium* or Fore-skin) and deſcending cloſe all the way to each other, when the *Pudendum* is ſhut, reaching but about half the breadth of the Orifice of the *Vagina*, and ending each in an obtuſe angle. They are almoſt triangular, and therefore, as alſo for their colour, are compared to the thrills that hang under a Cock's throat.

Their ſubſtance.

They have a red *ſubſtance*, partly fleſhy, partly membranous; within ſoft and ſpongy, looſly compoſed of thin Membranes and Veſſels, ſo that they are very apt to be diſtended by the influx of the Animal ſpirits and arterial blood.

Spirits they have from the ſame Nerves that run through the *Vagina*, and blood from that branch of the inner Iliacal Artery that is called *Pudenda:* Veins they have alſo from the *Venæ pudendæ*, which carry away the Arterial blood from them when they become flaccid. They are larger in grown Maids than in younger, and larger yet in thoſe that have uſed Venery or born Children.

Uſe. Their *uſe* is to defend the inner parts, to cover the Urinary paſſage, and a good part of the Orifice of the *Vagina*. And to the ſame purpoſes ſerve the *Labia* above deſcribed.

Above betwixt the *Nymphæ* in the upper part of the *Pudendum* does a part jet out a little that Clitoris. is called *Clitoris*, from κλειτορίζω, that ſignifies laſciviouſly to grope the *Pudendum*. It is otherwiſe called *Virga*, for it anſwers to a Man's Yard in ſhape, ſituation, ſubſtance, repletion with ſpirits and erection; it has nervous bodies, a *ſeptum*, a *glans*, muſcles and the like Veſſels with the *Penis*. But it differs therefrom, firſt in magnitude; for this is very ſmall in reſpect to that, as being not to be blown up to the thickneſs of ones little Finger. Secondly, the forked roots of the nervous bodies that lye hid within the fat of the *Pubes*, are twice as long as that part of it which is united into one body with the *ſeptum* between; whereas on the contrary in the *Penis* the united part is four times as long as the forked. Thirdly, the *Clitoris* wants an *Urethra*, and its prominent *glans* wants a *foramen*. Fourthly, it has only one pair of Muſcles. In ſome its united part grows to that length, as to hang out from betwixt the Lips of the *Pudendum*: yea there are many ſtories of ſuch as have had it ſo long and big as to be able to accompany with other Women like unto Men, and ſuch are called *Fricatrices*, or otherwiſe Hermaphrodites; who it is not probable are truly of both Sexes, but only the *Teſtes* fall down into the *Labia*, and this *Clitoris* is preternaturally extended. But in moſt it jets out ſo little as that it does not appear but by drawing aſide the *Labia*.

Its ſubſtance.

It is a little, long and round body, conſiſting (like a Man's *Penis*) of two nervous, and inwardly black and ſpongy parts, that ariſe on each ſide from the bunching of the *Os Iſchium*, and meet together at the joynting or conjunction of the *Oſſa pubis*. It lies under the fat of *Mons Veneris*, in the top of the great Fiſſure. In Venery by means of the two nervous bodies it puffs up, and ſtraitening the Orifice of the *Vagina* contributes to the embracing of the *Penis* the more cloſely.

Glans.

Its outer end is like to the *Glans* of a Man's Yard, and has the ſame name, (as alſo *Tentigo*.) And as the *Glans* in Men is the ſeat of the greateſt pleaſure in copulation, ſo is this in Women; whence it is called *Amoris dulcedo* and *Oeſtrum Veneris*. It has ſome reſemblance of a *Foramen*, but it is not pervious. It is moſt of it covered with a thin Membrane from the conjunction of the *Nymphæ*, which for its likeneſs to the *Præputium* in Men, is alſo called ſo.

Muſcles.

The *Clitoris* has formerly been affirmed to have two pair of *Muſcles* belonging to it. The upper are round, and ſpring from the Bones of the *Coxendix*, and paſſing a little way along the two nervous bodies above-deſcribed are inſerted into them. Theſe by ſtraitning the roots of the ſaid bodies do detain the Blood and Spirits in them, and ſo erect the *Clitoris*, even as thoſe in Men do the *Penis.* And this is the only pair which we ſuppoſe belong to the *Clitoris.* As for the other which ariſe from the *Sphincter ani*, they are thoſe we mention'd above in the end of the foregoing Chapter: for though they have been thought to ſerve for the erection of the *Clitoris*, yet we think with *de Graef*, that they are rather of the nature of a Sphincter, and contribute to the purſing up or conſtringing the outer Orifice of the *Vagina.*

Veſſels. It has *Veins* and *Arteries* from the *Pudendæ*, and *Nerves* from the ſame origine with the *Vagina*, which are pretty large.

Its *uſe* may be known from what has already been diſcourſed. And we will only note further, that in ſome Eaſtern Countries it uſes to be ſo large, that for its deformity and the hindrance it gives to copulation, they uſe to cut it quite out, or hinder its growth by ſearing it, which they improperly call Circumciſion.

Tab. IX.

Fig. I. Repreſenteth the Genital parts of a Woman taken out of the Body, and placed in their natural ſituation.

AA *The trunk of the great Artery.*
BB *The trunk of the* Vena cava.
C *The right Emulgent vein.*
D *The left Emulgent vein.*
E *The right Emulgent artery.*
F *The left Emulgent artery.*
GG *The Kidneys.*

TAB. IX.

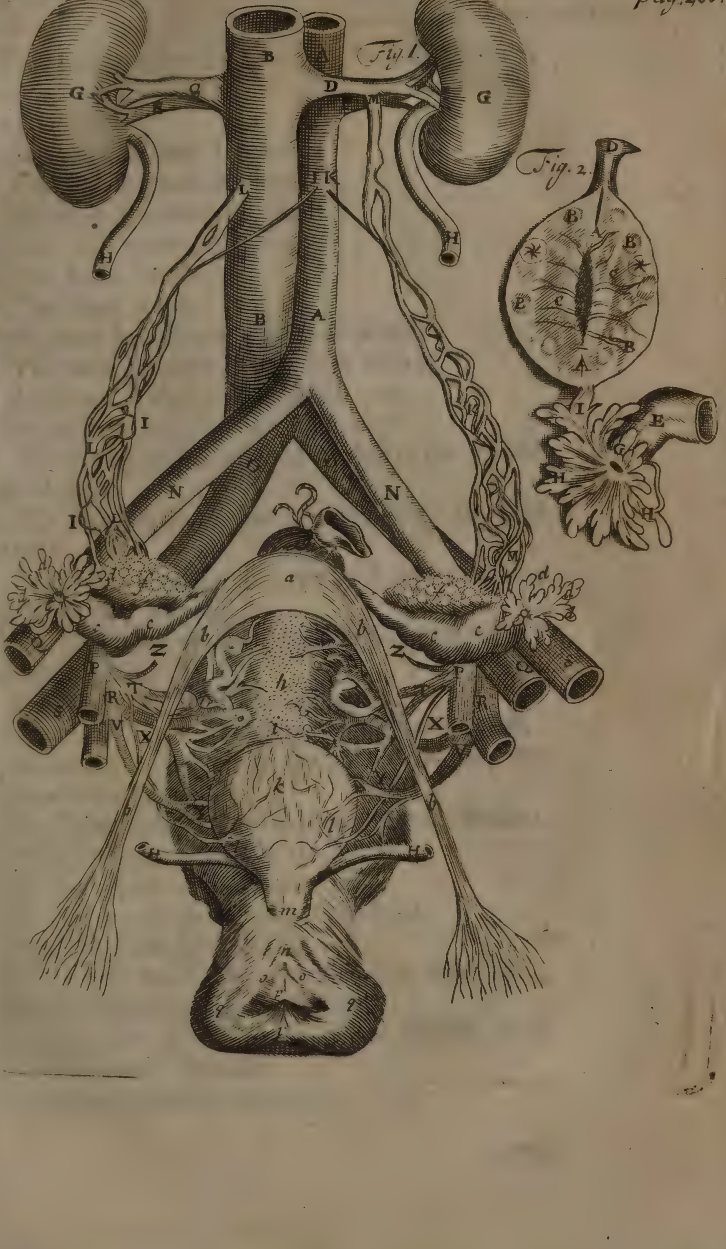
Fig. 1.
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Fig. 2.
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HHHH *The Ureters as they ariſe from the Kidneys and are inſerted into the Bladder, but their middle part cut off.*
III *The right Spermatick artery.*
KK *The left Spermatick artery.*
LL *The right Spermatick vein.*
MM *The left Spermatick vein.*
NN *The Iliack arteries.*
OO *The Iliack veins.*
PP *The inner branches of the Iliack artery.*
QQ *The outer branches of the Iliack artery.*
RR *The inner branches of the Iliack vein.*
SS *The outer branches of the Iliack vein.*
TT *The Hypogaſtrick arteries carried to the Womb and* Vagina.
UU *The Hypogaſtrick veins accompanying the ſaid arteries.*
XX *The branches of the Hypogaſtrick artery tending to the urinary Bladder.*
YY *The branches of the Hypogaſtrick vein carried to the Bladder.*
ZZ *Portions of the Umbilical arteries.*
a *The* Fundus uteri *cloathed with its common Coat.*
bb *The round Ligaments of the Womb as they are joyned to its* Fundus.
cc *The* Tubæ Fallopianæ *in their natural ſituation.*
ddd *The* Fimbriæ *or jags of the* Tubæ.
ee *The* Foramina *of the* Tubæ.
ff *The Teſticles in their natural ſituation.*
g *A portion of the ſtreight Gut.*
h *The neck of the Womb, diveſted of its outer Coat, that the Veſſels may be better ſeen.*
i *The fore-part of the* Vagina *of the Womb, freed from the urinary Bladder.*
k *The urinary Bladder contracted.*

ll *The Blood-veſſels running through the Bladder.*
m *The Sphincter muſcle conſtringing the neck of the Bladder.*
n *The* Clitoris.
oo *The* Nymphæ.
p *The Urinary paſſage*
qq *The Lips of the* Pudendum.
r *The Orifice of the* Vagina.

Fig. II. Exhibiteth a Woman's Teſticle or *Ovarium* with the end of the *Tuba* annexed to it.

A *The Teſticle opened lengthways in its lower part.*
BB *Eggs of divers bigneſs contained in the membranous ſubſtance of the* Teſtes.
CC *The Blood-veſſels in the middle of the* Teſtes, *proceeding plentifully from its upper part, as they run to the Eggs.*
DD *The Ligament of the Teſticles, whereby they are knit to the Womb, cut off.*
EE *A part of the* Tuba Fallopiana *cut off.*
F *The Cavity of the* Tuba *cut off.*
GG *The hole that is in the end of the* Tubæ.
H *The leavy ornament of the* Tubæ.
I *The leavy ornament of the* Tubæ *knit to the* Teſtes.

CHAP.

CHAP. XXX.

Of a Conception.

HAving deſcribed all the parts that ſerve for *Generation* both in Man and Woman, Order would that we ſhould ſpeak of the *efficient cauſes*, *matter* or *principles*, from whence that which is generated by and in them, doth proceed. And in the firſt place there occurs the Man's Seed, which is the *active principle*, or *efficient cauſe* of the *Fœtus*; but when we diſcourſed of the *Teſtes*, we ſhewed what the *matter* of it was, *viz.* Arterial blood and Animal ſpirits; and as to the manner of its fecundating the *Ovum*, we omit that, as being too Philoſophical for this place. In the next place therefore we muſt come to the *matter* or *paſſive* principle of the *Fœtus*, and this is an *Ovum* impregnated by the Man's Seed. And here becauſe in Women it cannot be obſerved by what degrees and in what time an *Ovum* in the *Ovarium* or *Teſtis* becomes a Conception in the *Uterus*, we muſt be forced to gueſs at that by the anology in other Creatures. To this purpoſe Dr. *Harvey de generatione Animalium*, is worthy to be read of the Curious; eſpecially concerning the manner and order of the generation of the parts of a Chicken in an Hen's Egg, in his *Exercit.* 56. But when he comes to apply this to the Conceptions of viviparous Animals, being ignorant that there was any formal *Ovum* pre-exiſting in them, and only then fecundated, he runs into great Errours and odd Notions about Conception; imagining an analogy betwixt the Brain's forming its Phantaſms or Conceptions, (which he calls *Animal)* and the Wombs forming hers, which he calls *Natural.* He rightly indeed rejects the Hypotheſis of the Woman's having true Seed, as alſo the Notion that the Man's Seed is any part of the Conception; but then he gives an unſatisfactory account of it, when he ſays, it is formed of the primeval albugineous humours that tranſude into the *Cornua* in Brutes, or *Uterus* in Women, after they are impregnated or matur'd, as he ſpeaks. For thoſe albugineous humours (as ſhall be ſhewn more fully afterwards) are not the firſt principle from which the *Fœtus* is formed, but the matter whereby its Lineaments firſt drawn within the *Ovum*, receive their encreaſe and perfection. I ſhall not therefore rehearſe the Hiſtory of generation in Harts that he has given us, for an analogical explication of that in Women; but ſhall tranſcribe the Obſervations of the Curious *de Graef* concerning the generation of Rabbets, as being more adapted to our purpoſe, and more conſonant to truth.

" We made the firſt Tryal (*ſays he*) on a fe-
" male Rabbet that had not yet accompanied
" with the male. Diſſecting which we obſerved
" a very wide *Vagina*, and about eight Fingers
" breadth long; which being opened length-
" ways, there ſtood out two narrow mouths in
" its upper part divided with a ſemilunar par-
" tition, namely the beginning of each *Cornu*:
" for the Womb in Conies is preſently from the
" very *Vagina* divided into two parts, one of
" which bends towards the right hand, the other
" towards the left, about three Fingers breadth
" aſunder, where they are preſently contracted
" and continued with the Oviducts, which in
theſe

“ theſe Animals have a peculiar ſituation (or
“ make:) becauſe if you lightly blow up the *Cornua*,
“ theſe will not ſwell, nor the wind penetrate
“ them becauſe of ſome looſe *Fimbriæ* or
“ jags cloſing like the Valve of the Gut *Colon*:
“ Theſe Oviducts being ſmall at their riſing from
“ the *Cornua*, for five Fingers breadth run with
“ a winding Duct beyond the Teſticles, widening
“ more and more by degrees, and then they
“ turn back towards them and end in the form
“ of a Tunnel. . . . . .The Teſticles are ſmall, but
“ contain very many limpid Eggs, which being
“ cut open there iſſued out a clammy liquor like
“ the White of an Egg. This being premiſed,

“ We opened another half an hour after the
“ *Coitus*, the *Cornua* of whoſe *Uterus* look'd a little
“ redder, but the *Ova* in the Teſticles were
“ not yet chang'd, unleſs they had remitted a
“ little of their clearneſs: but neither in the *Vagina*
“ nor in the *Cornua* could we perceive any
“ Seed, or any thing like it.

“ About ſix hours after the coupling we diſſected
“ another, in whoſe Teſticles the *Folliculi*
“ (or Caſes) of the *Ova* inclined to redneſs,
“ out of which being pricked with a Needle, a
“ clammy and clear liquor iſſued firſt, but blood
“ followed, flowing out of the Sanguinary veſſels
“ diſperſed through the *Folliculi*: We could find
“ no Seed neither in this Coney.

“ Four and twenty hours after the *Coitus*, we
“ opened another, in one of whoſe Teſticles we
“ found three, and in the other five *Folliculi* of
“ the *Ova* very much changed; for being before
“ limpid and colourleſs, they were now turn'd
“ duskiſh and of a faint red, in the middle of
“ whoſe Superficies a little *Papilla* (or Teat) as

"it were diſcover'd it ſelf: when the *Folliculi* "were cut open, there appear'd a little limpid "liquor in their middle, and in their circumfe-"rence a certain thicker and reddiſh matter.

"Twenty ſeven hours after the *Coitus* we in-"ſpected another, the *Cornua* of whoſe *Uterus* "with the Oviducts looked more bloody, alſo "the extremity of the Oviducts did on every ſide "embrace the *Teſtes* like a Tunnel; in the mid-"dle ſuperficies of the *Folliculi*, as in thoſe be-"fore, there ſtood out little *Papillæ*, through "which by preſſing the ſubſtance of the Teſti-"cles there iſſued a limpid liquor, which was "followed by another redder and thicker. Open-"ing the *Cornua* of the Womb we found no Eggs, "but the inner wrinkled Tunicle of the *Cornua* "was a little more tumid.

"Eight and forty hours after the *Coitus* we "examin'd another, in one of whoſe Teſticles "we found ſeven, in the other three *Folliculi* "changed, in whoſe middle the *Papillæ* were "ſomething more eminent, through which, by "preſſing the ſubſtance of the Teſticles, there iſ-"ſued a little liquor like the White of an Egg, "but the remaining reddiſh ſubſtance of the "*Ova*, being now become ſomething thicker, "was not ſo eaſily preſſed forth as in thoſe "before.

"Two and fifty hours after the *Coitus* we "viewed another, in one of whoſe Teſticles we "found one, in the other four *Folliculi* altered; "cutting open which we found a glandulous-like "matter, in the middle of which there was a "little Cavity, wherein finding no notable li-"quor, we begun to ſuſpect whether or no their "limpid ſubſtance, which is contained in proper

" Membranes, were burſt forth or expelled: " wherefore we ſearched carefully both the Oviducts and the *Cornua*, but we could find nothing; only the inner Tunicle of the *Cornua* " being much puft up, ſhined.

" Seventy two Hours, (or three Days and " Nights) after the *Coitus* we inſpected another, " which exhibited a far other and moſt wonderful change; for the *Infundibulum* did embrace " the Teſticles on every ſide moſt cloſely, which " being pull'd off we found in the Teſticle of " the right ſide three *Folliculi* a little greater and " harder, in the middle of whoſe ſuperficies we " ſaw a Tubercle with a little hole in it like a " *Papilla*; but diſſecting the ſaid Caſes through " the middle, their Cavity was quite empty: " wherefore we ſearched the ways through which " the *Ova* muſt paſs, again and again, and found " in the middle of the right Oviduct one, and in " the outer end of the *Cornu* of the ſame ſide two " very ſmall Eggs, little bigger than ſmall Pins-heads, which notwithſtanding their ſmalneſs " are cloathed with a double Coat; out of theſe " Eggs being pricked, there iſſued a moſt limpid " liquor.......In the very beginning of the *Cornu* " of the left ſide we found only one Egg, juſt like " thoſe ſmall ones of the other ſide: whence it is " clear that the *Ova* excluded out of the *Teſtes* " are ten times leſs than thoſe that yet ſtick in " the *Teſtes*; which ſeems to us to come to paſs, " inaſmuch as thoſe that are ſtill in the *Teſtes* contain as yet another matter, namely that of " which the glandulous ſubſtance of the Caſes " is made.

" The fourth Day from the *Coitus* we opened " another, in one of whoſe Teſticles we found

" four, in the other three Globules or Caſes emptied; and in the *Cornua* of the reſpective ſides " we found as many Eggs, greater than the former, which did not ſtick in the Oviducts or " beginnings of the *Cornua*, but were now rolled " on towards their middle: in their Cavity we " beheld as it were another Egg ſwimming, far " clearer than in the other before......

" The fifth day from the *Coitus* we diſſected " another, in whoſe *Ovaria* or Teſticles we told " ſix emptied *Folliculi*, that had each a notable " *Papilla*, through whoſe Foramen we eaſily put " an ordinary briſtle into their Cavity: we found " alſo the ſame number of Eggs (bigger than " thoſe the day before) in divers parts of the " *Cornua*, in which they lay ſo looſely, that by " blowing only, one might drive them this way " or that way. The inner Tunicle of theſe (or " the Egg within an Egg as it were) was become " yet more conſpicuous.

" The ſixth day after the *Coitus* we examin'd " another, in one of whoſe Teſticles we obſerv'd " ſix Caſes emptied, and in the *Cornu* of the ſame " ſide we could light of but only five Eggs " near the *Vagina*, brought as it were upon a " heap: and in the Teſticle of the other ſide we " found four *Folliculi* emptied, and in the *Cornu* " of that ſide only one Egg: The cauſe of which " difference we ſuppoſe to be, either becauſe ſome " Eggs by the wave-like motion of the *Cornua* " (not unlike the periſtaltick motion of the " Guts) being carried downwards towards the " *Vagina* were driven forth; or becauſe being " conſumed in the *Folliculi* they came not to the " *Uterus*; or light on ſome other miſchance. " Theſe Eggs were as big as ſmall peaſe.

“ The ſeventh day from the *Coitus* we examin’d “ another, in whoſe *Ovaria* we found ſome *Folli-* “ *culi* emptied that were greater, redder, and “ harder than the foregoing, and ſaw as many “ tranſparent Tumors or Cells in divers parts of “ the *Uterus*; out of which being opened we tur- “ ned *Ova* as big as Pocket-piſtol Bullets, in “ which we beheld nothing but the inner Tunicle “ very conſpicuous and a moſt limpid humour. “ It is to be wondred at, that in ſo ſhort a ſpace “ of time the Eggs ſhould imbibe ſo great plenty “ of liquor, that whereas before they might eaſi- “ ly be taken out of the Womb, now they could “ very difficultly.

“ The eight day from the *Coitus* we opened “ another, in the right *Cornu* of whoſe *Uterus* “ we ſaw one, in the left two Cells; one of theſe “ was almoſt twice as big as the other: for Na- “ ture doth ſometimes ſo vary, that there are “ Eggs of divers bigneſs found not only in divers “ Animals of the ſame ſpecies diſſected at the “ ſame diſtance from the *Coitus*, but alſo in one “ and the ſame Individual. In the horns of the “ Womb being opened we ſaw the Eggs a little “ bigger than the day before, but all of them, “ their Tunicles breaking, poured out their clear “ liquor before we could take them quite out: “ for which reaſon we tried another diſſected “ likewiſe the eighth day after the *Coitus*; the “ right *Cornu* of whoſe *Uterus* we ſaw ſwelled up “ into two, and the left into four tranſparent “ Tumours or Cells, out of which that we might “ take the *Ova* we uſed the greateſt diligence “ and attention; but as ſoon as we came to them, “ their Tunicles were ſo very tender that they “ burſt as the former: which when we ſaw, the

“ Eggs that remained we boiled with the *Uterus*,
“ whereby their Contents harden’d like the
“ Whites of Hen’s Eggs. The inner ſubſtance
“ of the Cells, on that ſide whereon it receives
“ the Hypogaſtrick veſſels, was become more
“ tumid and red.

“ The ninth day after the *Coitus* we diſſected
“ another that was old; the Teſticles of this
“ were almoſt as big again as thoſe of younger:
“ in the right we ſaw two, in the left five *Folliculi*
“ lately emptied, and beſides theſe, others
“ that look’d very pale, which we judged to be
“ thoſe that had been emptied the *Coitus* before
“ this, although for the moſt part they leave
“ only ſome paliſh points or ſpecks, to which the
“ encreaſe of the Teſticles is owing. The *Folliculi*
“ of the laſt *Coitus* were each beſet with a
“ *Papilla*, but the others were ſmooth. In the
“ right *Cornu* there were two, and in the left
“ five Cells, whoſe ſubſtance being more rare and
“ pellucid than the other parts of the *Uterus*, was
“ interwoven with many twigs of Veins and Ar-
“ teries. Opening ſome of theſe Cells, we could
“ ſee the *Ova*, but could not take them out
“ whole; wherefore being compelled to examine
“ the Content of the Eggs in the very hollow of
“ the Cells, we found it clear like Cryſtal; in
“ the middle whereof a certain rare and thin
“ cloud was ſeen to ſwim, which in other Conies
“ diſſected likewiſe on the ninth day after the
“ *Coitus*, for its exceeding fineneſs eſcaped our
“ ſight. The inner ſubſtance of the Cells, namely
“ that which receives the Hypogaſtrick veſſels,
“ being more tumid than the reſt, exhibited the
“ rudiments of the *Placenta*.

“ The tenth day after the *Coitus* we inſpected
“ another,

"another, in whoſe right Teſticle we found one "onely *Folliculus* emptied, which by reaſon of "the Sanguineous veſſels diſperſed plentifully "through it, was redder and had a leſs *Papilla*; "in the middle of this pale ſubſtance there ap-"pear'd as yet a very ſmall Cavity: but in the "left Teſticle we found ſix ſuch *Folliculi*. In the "*Cornua* of the *Uterus* we found alſo ſo many "Cells, namely one in the right and ſix in the "left, diſtant a Fingers breadth one from ano-"ther, in the middle of which Cells lay a rude "mucilaginous draught of the *Embryo* like a little "Worm. One might alſo plainly diſcern the "*Placenta* to which the Egg by means of its *Cho-*"*rion* was annexed. The matter of the Eggs "boil'd with the Womb hardned like the White "of an Egg, and taſted like the boiled congealed "ſubſtance of the Eggs in the Teſticles.

"The twelfth day after the *Coitus* we opened "another, in one of whoſe Teſticles we found "ſeven, in the other five *Folliculi* emptied, and "as many Cells in the *Cornua* much bigger and "rounder than the foregoing, in the middle of "which the *Embryo* was ſo conſpicuous, that one "might in a ſort diſcern its Limbs. In the regi-"on of its breaſt two ſanguineous ſpecks, and as "many white ones did offer themſelves to view: "in the *Abdomen* there grew a certain mucilagi-"nous ſubſtance inclining here and there to red. "We could not diſcern more in this ſhapeleſs "little Animal becauſe of its tenderneſs.

"The fourteenth day after the *Coitus* we diſ-"ſected another, the Cells of whoſe *Uterus* we "beheld to be yet greater, and their ſanguineous "veſſels more and more turgid: we alſo noted "that the Cells the larger they grew, came alſo

" nearer to one another, and their Interſtices " were leſſened. The Membranes *Amnios* and " *Chorion* were knit together, which though they " appear thicker and ſtronger, are yet more hard " to be ſeparated from one another than in the " *Ova* taken intirely out of the Womb; tearing " theſe we ſaw an *Embryo* with a great and pellucid Head, with the *Cerebellum* copped; its " gogle Eyes, gaping Mouth, and in ſome ſort " its little Ears might be diſcovered alſo. Its " Back-bone was drawn out, of a white colour, " which bending in about the *Sternum* reſembled " a Ship; by whoſe ſides moſt ſlender Veſſels run, " whoſe ramifications were extended to the Back " and Feet. In the region of the Breaſt two ſanguineous ſpecks greater than the foregoing exhibited the Rudiments of the Ventricles of the " Heart; at the ſides whereof were ſeen two " whitiſh ſpecks for Lungs. In the *Abdomen* being opened, there firſt ſhew'd it ſelf a reddiſh " Liver; then a white Body, to which was knit " a mucilaginous matter like a writhed thread, " being the rudiments of the Stomach and Guts. " All which in thoſe that we diſſected afterwards " had acquired only a greater bulk and perfection. And therefore to prevent tediousneſs " by repeating the ſame things, we will on purpoſe paſs by all the other diſſections we made " in this kind of Creature, excepting only one " which we made the day before the kindling; " that thoſe things that in the former were only " confuſedly diſcerned, may appear plain in " this.

" At length on the twenty ninth day after the " *Coitus* we inſpected another, that had kindled " ſix weeks before, and in the *Coitus* by which

“ ſhe was impregnated had voided all the thicker
“ part of the Seed of the Male, which in ſome
“ meaſure did reſemble the conſiſtence of a moſt
“ limpid jelly. In her *Ovaria* we found eleven
“ little whitiſh *Folliculi*; and beſides theſe, others
“ far leſs, little or nothing differing from the
“ ſubſtance of the *Teſtes*. The *Folliculi* of the
“ *Ova* in the *Teſtes* ſeem not to vaniſh wholly,
“ but to leave a certain ſpeck in them; whence
“ it certainly comes to paſs, that Conies, the oft-
“ ner or the more young ones they bring forth,
“ have the greater and whiter Teſticles; ſo that
“ one may gueſs by only viewing the *Teſtes*, whe-
“ ther they have had many young ones or often.
“ Having view'd the *Ovarium* we paſt to the *Ute-*
“ *rus*, which we found no longer diſtinguiſh'd in-
“ to Cells, but all along diſtended like a Pud-
“ ding; which was ſo agitated with a wave-like
“ motion, like the periſtaltick of the Guts;
“ that the young ones neareſt the *Vagina* as yet
“ included in their Membranes were excluded;
“ and that ſo haſtily, that if we had not cut out
“ the whole *Uterus*, they had all certainly gone
“ the ſame way. The Womb was no thicker
“ than when they are not with young, other-
“ wiſe than we have ſaid it to be in Women. In
“ its Cavity we ſaw eleven *Fœtus* ſprawling, which
“ were all ſo cloſely coupled together by the
“ Membrane *Chorion* (wherein all are ſeverally in-
“ volved) as if they had all been included in one
“ and the ſame *Chorion*——

Thus much I thought fit to tranſlate of that accurate Anatomiſt's Obſervations concerning the generation of this ſort of Animal, becauſe it gives ſo very great light into the manner of the generation of an humane *Fœtus.* For there is an exact analogy betwixt them, abating ſome circumſtances; as *Firſt*, that in Women the Conception is not formed in the *Cornua*, ſeeing her Womb has none, nor in the *Tubæ* very ſeldom and according to nature, for they are only the *Infundibula* or Oviducts to convey the *Ova* from the *Teſtes* to the *Fundus uteri*, though they bear ſome reſemblance to the *Cornua* in Brutes; I ſay the Conception is not formed in theſe, but in the *Fundus uteri* or Womb properly ſo called, whereinto the *Ovum* being received, preſently begins to ſwell and grow bigger, and there appears as it were an Egg within an Egg, by means of the two Membranes with which it is cloathed; which Membranes are originally in the *Ovum* while it is in the Teſticle, and imbibe the moiſture that is ſent now plentifully into the Womb, even as the little Yelks in Hens, *&c.* gather the White about them in the Oviduct and *Uterus*, which they have none of in the *Ovarium*; or as Seeds in the Ground do imbibe the fertile moiſture thereof to enable them to ſprout. *Another* conſiderable circumſtance wherein they differ, is the ſlow procedure of the formation of the *Fœtus* in Women in compariſon of that in Conies now deſcribed. For ſeeing theſe go with young but 29 or 30 Days, and Women 9 Months, we muſt imagine that the *Embryo* is as perfectly formed in the former on the tenth Day as in the latter in the tenth Week, or longer. But I ſay, abating theſe, or if there be any other ſuch like circumſtances, there is ſo great a likeneſs betwixt the one and the other, that without inſiſting more on the matter or manner of the Conception, we ſhall paſs on to the deſcription of the parts that encompaſs the *Fœtus*, then ſhew how it is nouriſhed, and laſtly what parts there are in a *Fœtus* that differ from thoſe in a Child born.

CHAP. XXXI.

Of the Placenta Uterina *or* *Womb-liver, and* Acetabula.

Upon the cutting open the Womb of a Woman with Child, the firſt thing that offers it ſelf is the *Placenta uterina*, or Womb-cake, otherwiſe called *Hepar uterinum*, or Womb-liver, from the likeneſs of ſubſtance, and alſo uſe, according to thoſe that impoſed the name. Placenta uterina.

Its *ſubſtance* is very like that of the Spleen, only that is more brittle and this more tough and tenacious, ſo that it cannot ſo eaſily be ſeparated from the Veſſels. It is ſoft, and has innumerable Fibres and ſmall Veſſels. Its *Parenchyma* is partly, if not altogether, glandulous. *Its ſubſtance.*

It is of very different *ſhapes* in ſeveral Creatures, but in Women it is circular, yet with ſome inequalities in its circumference. It is two Fingers breadth thick in its middle, (but thinner near the edges) and a ſpan or a quarter of a yard over from one ſide to the other when the *Fœtus* is come to maturity ready for the birth. On that ſide next the *Fœtus* it is ſmooth and ſomething hollowiſh like Navel-wort, and grows every where firmly to the *Chorion*; but on that next the Womb it is very unequal, having a great many tubercles or bunchings whereby it adheres faſt and immediately to the Womb. But *Shape and ſituation.*

to what part of it, is not agreed among Anatomiſts, ſome affirming it to grow to the fore-part, ſome to the hinder-part; ſome to the left ſide, others to the right. Dr. *Wharton* (aſſenting to *Fallopius*) ſays, it always adheres to one of the two corners of the Womb (that anſwer in ſome manner to the *Cornua* in Brutes) whereinto the *Foramen* of the *Tuba* opens; ſo that he ſays, the ſaid *Foramen* is as it were the centre to the *Placenta*. *De Graef* thinks it is moſt commonly faſten'd there, but not always, becauſe the *Ovum* for a while being looſe in the Cavity of the *Uterus*, may be tumbled to this or the other part, and where ever it fixes, there it is joyn'd to the Womb by the *Placenta*.

Number. When there is but one *Fœtus* in the Womb, it is but one; but if there be Twins, then according to Dr. *Wharton*, &c. are there two *Placentæ*, either diſtinct in ſhape, or if they appear in the ſhape of one, then are they ſeparated by a Membrane one from the other; and a particular rope of Umbilical veſſels is inſerted into each from each *Fœtus*. But Dr. *Needham* affirms, that there is generally but one *Placenta* even when there are two or more *Fœtus*. Nor does that line that ſeems to divide the *Placentæ* from one another, really do ſo. For the Veſſels of the right hand *Fœtus* extend beyond this line to the left ſide of the *Placenta*; and on the contrary, 'tis but ſeldom, ſays he, that the *Placentæ* are multiplied according to the number of the *Embryo's*.

Origine. It grows not out of the Womb originally, but its firſt rudiments appear like a woolly ſubſtance on the outſide of the outer Membrane that inveſts the *Embryo* (called *Chorion*) about the eighth or ninth Week, upon which in a ſhort while a red, carnous and ſoft ſubſtance grows, but unequally and in little knobs, and then it preſently thereby ſticks to the Womb, and is very conſpicuous about the twelfth or thirteenth Week. Till now the *Fœtus* is encreaſed and nouriſhed wholly by the appoſition of the cryſtalline or albugineous liquor wherein it ſwims looſe in the inner Membrane (called *Amnios)* having no *Vaſa umbilicalia* formed, by which to receive any thing from the *Placenta.* But when it waxes bigger and begins to need more nouriſhment, the extremities of the Umbilical veſſels begin to grow out of the Navel by little and little, and are extended towards this *Placenta*, that out of it, as Plants by their Roots out of the Earth, they may draw a more firm nutritive juice, and carry it to the *Fœtus.* But of this more in the 33*d.* Chapter.

It has *Veſſels* from a double Origine, ſome from the Womb, and ſome from the *Chorion* immediately, but mediately from the *Fœtus.* The former are of four kinds, Arteries, Veins, Nerves and Lympheducts: all which though they be very large and conſpicuous in the Womb, and are ſo even in that very place where the *Placenta* is joyned to it: yet they ſend but the ſmalleſt Capillaries into the *Placenta* it ſelf, and are diſperſed only through that ſide of it that is next the Womb. Thoſe that come from the *Chorion* are Arteries and Veins, and Dr. *Wharton* ſuppoſes alſo Lympheducts. The Arteries and Veins that come from the Womb ſpring from the Hypogaſtricks, and alſo that branch of the Spermaticks that is inſerted into the bottom of the Womb. Thoſe that come from the *Chorion* are the Umbilical veſſels of the *Fœtus.* Of the uſe of both the one and other we ſhall ſpeak in *Veſſels.*

Chap. 33. when we come to diſcourſe how the *Fœtus* is nouriſhed, as alſo of the uſe of the *Placenta* it ſelf, of which we ſhall only obſerve this further here; That after it is joyned to the Womb, it ſticks moſt firmly to it for the firſt months, as unripe Fruit do to the Tree: But as the *Fœtus* becomes bigger, and riper, and nearer to the birth, by ſo much the more eaſily will it part from the Womb; and at length, like to ripe Fruit, after the Child is born, it falls off from the Womb, and makes part of the After-birth.

Acetabula. It was an old tradition continued for many hundred years, that the *Placenta* adheres to the Womb by certain parts called *Cotyledones* or *Acetabula.* That there are ſuch in ſome Creatures it is certain; Dr. *Needham* ſays, they are only properly ſo called in Sheep and Goats, in whom being with young the Uterine glands are hollow like a Saucer or an Acorn-cup, and are adapted to the little Prominences (or *Digituli*) of the *Placentulæ* that grow on the *Chorion*, (though *Diemerbroeck* ſay, that on the contrary the *Placentulæ* are hollow, (and ſo are truly the *Acetabula)* and the Uterine glands protuberant) and doubts not but theſe names were firſt given by thoſe that diſſected theſe kind of Creatures, and were afterwards applied in following ages to other Animals. So that no wonder there have been ſo great conteſts even about the ſignification of the word *Cotyledon*, (which is the Greek word for the Herb *Umbilicus Veneris* or Navelwort) and what that was that was ſo called in the ſeveral Creatures that were ſaid to have them. But becauſe ſuch Controverſies are now obſolete, and that 'tis generally confeſſed that Women have them not, we ſhall not in this

Epitome run out into needleſs Diſputes; but only obſerve one ſingular Opinion of *Diemerbroeck*, who aſcribes *Cotyledones* to Women. He thinks that each Woman (unleſs ſhe go with Twins) has but one *Cotyledon*, and that the foreſaid *Placenta uterina* is it. And indeed it muſt be confeſt that it reſembles much the ſhape of that from which the *Cotyledones* have their name; and therefore ſeeing he formed this Opinion to defend our great Maſter *Hippocrates*, who had aſcribed them to Women, (that is, as *Diemerbroeck* expounds it, one *Cotyledon* to one Woman) we ſhall not oppoſe it, but confeſs it to be, if not true, yet both ingenious and ingenuous.

CHAP. XXXII.

Of the Membranes involving the Fœtus, *and of the Humours and Air contained in them.*

NExt to the *Placenta* follow the two *Membranes* that involve the whole *Fœtus*, *Chorion* the outer, and *Amnios* the inner: betwixt which two, after the *Fœtus* is perfectly formed, Dr. *Needham*, &c. affirms there is a third, *viz.* *Allantoides*, which in Women likewiſe includes the whole *Fœtus* *. Of each of theſe in their order, with the *liquors* they contain.

* *Needh.* de formato fœtu, *p.* 59.

The outmoſt *Membrane* is called *Chorion*; it is pretty thick, ſmooth on the inſide, but without, ſomething unequal or rough; and in that part of it that adheres to the *Placenta* and by it to the Womb, has very many Veſſels which ſpring from

Chorion.

the *Placenta* it ſelf, and from the Umbilical veſſels. Thoſe which ſpring from the *Placenta* are diſperſed through it before the *fœtus* is ſhaped, (as *Diemerbroeck* affirms;) but the latter not till the Navel-rope is grown out to a juſt length, at which time they enter it and intermix with the former, and from this Membrane are inſerted into the *Placenta* to which the *Chorion* adheres. It is but one even when the Mother goes with Twins: for, as in a Nut that has two Kernels in it, they are both included within the ſame Shell, but are each inveſted in their proper Membrane; ſo Twins are both incloſed in one *Chorion*, but have each a particular *Amnios*. It inveſts the *Ovum* originally, which *Ovum* being brought into the Womb, and becoming a Conception, this Membrane imbibes the moiſture that bedews the Womb plentifully at that time. For whiles the Conception is looſe in the Womb, and has no Veſſels that reach out of it ſelf, nor is faſten'd to any part, it muſt have its encreaſe after the ſame manner as the Egg has in Hens, " which while it " is in the *racemus* or knot, conſiſts of no other " ſubſtance but Yelk; and when it drops off from " thence and deſcends through the *Infundibulum*, " it receives no alteration; but when it comes " into the Cells of the proceſs of the *Uterus*, it " begins to gather a White, although it ſtick to " no part of the *Uterus*, nor has any Umbilical " Veſſel; but (*ſays my Author*, the immortal " *Harvey* *) as the Eggs of Fiſhes and Frogs do " without, procure to themſelves Whites out of " the water; or as Beans, Peaſe, and other Pulſe, " and Bread-corn being ſteep'd in moiſture ſwell, " and thence acquire aliment for the bud that is " ſpringing out of them: ſo in like manner out " of

* De generat. Animal. Exercit. 9. de generat. Ovi.

"of the *plicæ* or wrinkles of the Womb (as out "of a Dug or Womb-cake) does there an albu"gineous moiſture flow, whence the Yelk (by "that vegetative and innate heat, and faculty "wherewith it is endued) gathers and concocts "its White. And therefore in thoſe *plicæ* and "the hollow of the Womb does there plentifully "abound a liquor reſembling the taſte of the "White. And thus the Yelk deſcending by lit"tle and little is encompaſſed with a White, till "at laſt in the outmoſt *Uterus* having aſſumed "Membranes and a Shell, it is perfected.] Thus I ſay does the *Chorion* imbibe that albugineous liquor that from the firſt Conception encreaſes daily in it, (and tranſudes through the *Amnios* wherein the *Embryo* ſwims) till the Umbilical veſſels and the *Placenta* are formed, from and through which the *Fœtus* may receive nouriſhment.

This *liquor* that it imbibes I take to be nutritious juice that ouzes into the Cavity of the *Uterus* out of the capillary Orifices of the Hypogaſtrick and Spermatick Arteries, and is of the ſame nature with that which afterwards is ſeparated in the *Placenta* and carried to the *Fœtus* by the Umbilical Vein, and with that alſo which abounds in the *Amnios* even till the birth. For the plaſtick or vegetative vertue is only in the *Ovum* it ſelf, and the augmentation that the firſt Lineaments of the *Embryo* receive, is only by appoſition of this nutritious albugineous juice. But this Membrane *Chorion* by that time the Umbilical Veſſels and *Placenta* are formed, is grown ſo denſe and compact, that it is not capable of imbibing more; but that which at this time is in it, does in ſmall time tranſude into the *Amnios*, and

Its liquor.

ſo it ſelf becomes empty, and gives way to the encreaſe of the *Allantoides*, (which thenceforward begins to appear) whoſe liquor augments daily as the *Fœtus* grows nearer and nearer to the birth. This is my conjecture, which I ſubmit to the cenſure of the learned.

Amnios.

The *Amnios* is the inmoſt Membrane that immediately contains the *Fœtus*. It is not knit to the *Chorion* in any place ſave where the Umbilical Veſſels paſs through them both into the *Placenta*. It is very thin, ſoft, ſmooth, and pellucid, and encompaſſes the *fœtus* very looſly. It has Veſſels from the ſame origins as the *Chorion*. It is ſomething of an oval ſhape.

Its liquor.

Before the *Ovum* be impregnated, this Membrane contains a limpid *liquor*, which after the impregnation is that out of which the *Embryo* is formed. In it reſides the plaſtick power, and the matter alſo out of which the firſt lineaments of the *Embryo* are drawn. But becauſe its liquor is ſo very little, there tranſudes through this Membrane preſently part of that nutritious albugineous humour that is contained in the *Chorion*, which it had imbibed out of the *Uterus*, as was but even now ſhewn. And by the juxta-appoſition or addition of this humour to the undiſcernible rudiments of the *Embryo*, it receives its encreaſe. But though the *Amnios* have its additional nutritious liquor at firſt only by tranſudation; yet when the Umbilical Veſſels and the *Placenta* are formed, it receives it after another manner. For then this liquor being ſeparated from the Mother's Arteries by the *Placenta*, and imbibed by the Umbilical Vein of the *fœtus*, it paſſes directly to its heart, from whence being driven, a great a great part of it, down to the *Aorta*, it is ſent forth again by the Umbilical Arteries, out of whoſe Capillaries diſperſed plentifully through the *Amnios* it iſſues into its Cavity, even as far more groſs and viſcid juices in taking a purge (or ſometimes critically) ouze into the Inteſtins out of the ſmall mouths of the Arteries; though indeed it be here by the intervention of Glands, which 'tis hoped the Curious will ſometime diſcover alſo in the *Amnios*.

There are ſome that think they have obſerved *Venæ lacteæ* to come directly to the *Placenta*, and that out of it (as out of the Glands in the Meſentery) there ariſe others that convey the Chyle into the *Amnios*: and this indeed were a plauſible Opinion, if it were grounded on any certain or frequent Obſervation of ſuch Lacteals, and were not rather invented to avoid ſome difficulties with which the former Opinion ſeems to be preſſed.

Note, that though the liquor contained in both the *Chorion* and *Amnios* be in colour and conſiſtence very like the *ſerum* of the blood; yet it differs ſo much from the nature of that, that being held over the Fire in a Spoon, it will not coagulate, as the *ſerum* will.

Allantoides. A third *Membrane* which inveſts the whole *fœtus* (according to Dr. *Needham*, &c.) is that called *Allantoides*, though improperly as to Women. For it is ſo called from its likeneſs to a Pudding (*ἀλλᾶς ντος*, *farcimen*) which indeed it does reſemble in Sheep, Does, Hogs, *&c.* but in Women, as alſo in Mares, it has the ſame Figure as the *Chorion* and *Amnios*, betwixt which it is placed in their whole circumference, (as the ſaid obſerving Anatomiſt affirms.) Now though it muſt be ſuppoſed that this as well as the other two, is originally in the *Ovum*, yet there is no appearance of it till after the Umbilical veſſels and *Placenta* are formed, and the albugineous liquor (ſo often mentioned) ceaſes to be imbibed by the *Chorion* out of the *Uterus*. But as ſoon as the *fœtus* begins to be nouriſhed by the Umbilical veſſels, and the *Urachus* is permeable, then preſently this Membrane begins to ſhew it ſelf, containing a very thin liquor, which is the Urine of the *fœtus* brought into it by the *Urachus* from its Bladder ; and with which it is filled daily more and more till the birth. It is very thin, ſmooth, ſoft, and yet denſe. It may be known from the *Chorion* and *Amnios* by this, that they have numerous Veſſels diſperſed through them, but this has not the leaſt viſible Vein or Artery. It is very hard to ſeparate the *Chorion* from it, becauſe when it appears, the *Chorion* becomes void of all liquor, and ſo claps cloſe to it. But towards the birth of the *fœtus* it becomes ſo turgid with Urine, that the *Amnios* (immediately containing the *fœtus*) ſwims in it, and ſo may moſt eaſily be diſtinguiſht and ſeparated from it.

Its liquor. The *liquor* that it contains is (as has been ſaid) the Urine of the *fœtus* brought hither by the *Urachus*. For as ſoon as the *fœtus* is perfectly formed, its Kidneys muſt needs perform their office of ſeparating the *Serum* from the blood, for otherwiſe it would be affected with an *Anaſarca*, or other ſort of Dropſie. I ſay, the *Serum* is ſeparated in the Kidneys, and glides down from thence into the Bladder, in which it is found pretty plentiful when the *fœtus* is five or ſix Months old. Now it flows not out of the Bladder by its neck, becauſe at that time the Sphincter is too contracted and narrow, and if it ſhould paſs that way, it would mix with that nutritious juice in which the *fœtus* ſwims in the *Amnios*, and wherewith, by taking it in by its Mouth, it is partly nouriſhed, and ſo would defile and corrupt it, and make it unfit for nouriſhment. Nature therefore has provided it another *exit* by the *Urachus* inſerted into the bottom of the Bladder; which though after the Child is born it grow ſolid like a Ligament, like as the *Vena umbilicalis* does, yet while the *fœtus* is in the Womb it is always pervious, and conveys the Urine into the *Allantoides* that is placed betwixt the *Chorion* and *Amnios*, where it is collected and preſerved till the birth.

Beſides theſe three Membranes, Dr. *Needham* has obſerved a fourth in Cats, Bitches, and Coneys, containing a nutritious liquor; but I ſhall not here deſcribe the ſame, becauſe it is not my deſign to be ſo copious as to treat of any part in other Animals, whereto there is not ſomething anſwerable in an humane body.

Air in the Membranes.

Note, that according to Dr. *Needham*'s Obſervation, theſe Membranes are not only filled with liquors, but contain a pretty deal of air. For if one take a Secundine up in his hand, he ſays, one may obſerve in the uppermoſt part of the Membranes a pretty diſtance between the Membrane and the liquor contained in it. And he thinks that the *Vagitus uterini*, (of which he gives an inſtance not to be denied) are a clear demonſtration, that there is air, at leaſt in the *Amnios*. And the piping of Chickens in the Egg, before either the Shell or the Membranes be broke, evince the ſame. And ſeeing there appears no way whereby the wind ſhould enter from without, he is of opinion that it is bred in the Membranes themſelves; that is, that the liquor which is pretty ſpirituous, and fitted for the fermentation and concoction of the *Fœtus*, and therefore well repleniſht with air, may well be ſuppoſed to yield plenty of exhalations; by the interpoſition whereof the Membranes, being ſeparated from the humours, are kept ſo lax, that they may yield to all the motions both of the *Fœtus* and of the Mother, without danger of burſting. For this air does not ſo diſtend the Membrane, but that by blowing, it will widen to thrice as large a dimenſion as the liquor it contains, and the air too, do extend it.

CHAP. XXXIII.

Of the Umbilical Veſſels, and of the nouriſhing of the Fœtus.

The Navel-ſtring. Having opened the Membranes that enwrap the *Fœtus*, there appears the *Navel-ſtring* or *Rope*, which is membranous, wreath'd and unequal, ariſing out of the middle of the *Abdomen*, (*viz.* the Navel) and reaching to the Womb-liver or *Placenta*, of a notable length; being three ſpans or half an Ell long, and as thick as ones Finger. It was convenient to be ſo long and lax, that when the *Fœtus* in the Womb grows ſtrong, it might not break it by its ſprawling and tumbling about; and after it is born, the Secundines or After-birth might be drawn out the better by it.

Its ſituation. The way that it paſſes from the Navel to the *Placenta* is very unconſtant; for ſometimes it goes up on the right hand to the Neck, which having encompaſſed, it deſcends to the *Placenta*, and ſometimes it goes on the left hand up to the Neck, &c. Sometimes it comes not to the Neck at all, but goes firſt a little up towards its Breaſt, and then turns round its Back, and from thence paſſes to the *Placenta*.

Veſſels. The *Veſſels* contained in this ſtring (and which are enwrapped in a common Coat called *Funiculus* or *Inteſtinulum*) are four, one Vein, two Arteries and the *Urachus*.

Vein. The *Vein* is larger than the Arteries, and ariſes from the Liver of the *fœtus*, (*viz.* out of its Fiſſure) by the Trunk of the *Vena portæ* (of which it ſeems to be but a branch) and from thence paſſing out of the Navel, it runs along the *Funiculus* to the *Placenta*, into which it is implanted by innumerable roots; but in its paſſage it ſends ſome little twigs into the *Amnios*.

Its uſe. The Ancients that thought the *Fœtus* was nouriſhed by the Mother's blood onely, taught the ſole *uſe* of this Vein to be, to carry blood from the *Placenta* to it: and ſince it has been found out and believed that it is nouriſhed alſo (if not onely) by Chyle or *Succus nutritius*, ſome have continued the ſame office to this Vein, and think that the Chyle is brought by Lacteal Veſſels ariſing out of the *Placenta*, as (they ſay) it was brought thither by the Mother's Lacteals. And indeed if any certain diſcovery had been made of theſe ſame *Lacteæ*, we ſhould have embraced this Opinion as the moſt probable. But we are not to form Hypotheſes out of rational Notions onely, but much rather from what appears to the Eyes of the Diſſector. We do affirm therefore that the Umbilical Vein ſerves for conveying to the *fœtus* the nutritious juice ſeparated in the *Placenta* from the Mother's Arteries. How this ſeparation is made, and how it is firſt of all turned into blood, we ſhall conſider by and by.

But together with this juice, there returns ſo much of the Arterial blood (that comes from the *fœtus*) as is not ſpent upon the nouriſhment of the *Placenta*, or of the *Chorion* and *Amnios*. Which liquors thus mixed though by the Umbilical Vein they are poured into the *Sinus* of the *Porta*, yet are they not diſtributed through the Liver by the uſual Chanels thereof only, but by the Venal duct (deſcribed before, Ch. 12.) is the greateſt part thereof conveyed in a direct courſe and full ſtream into the *Cava* above the Liver.

Beſides this Vein which is common to all Creatures, there have been obſerved in Whelps and Coneys (and may perhaps in others) two ſmall Veins more that, ariſing from the fourth involving Membrane peculiar to them, paſs directly from the *Umbilicus* to the Meſentery of the *fœtus*, as the other great one does to its Liver; which may ſtrengthen the Opinion, that the Chyle or *Succus nutritius* is brought to the *fœtus* by the Umbilical Vein (or Veins.) Theſe Veins Dr. *Needham* calls *Omphalo-meſentericæ*.

Arteries. In the *Funiculus* are included alſo two *Arteries*, which are not both of them together ſo big as the Vein. They ſpring out of the inner Iliacal branches of the great Artery; (Dr. *Needham* judges them to be derived immediately from the extremity of the *Aorta* before its diviſion) and paſſing by the ſides of the Bladder they riſe up to the Navel, out of which they are conducted to the

Placenta in the ſame common cover with the Vein and *Urachus*, with which they are twined and wreathed not unlike a Rope. I ſay, they are inſerted into the *Placenta*, and with the Vein make a moſt admirable Net-like texture. But there is one branch of each of them which is manifeſtly inſerted into the *Amnios*. Dr. *Harvey* ſays, the Vein is conſpicuous a pretty while before theſe Arteries appear.

In the Creatures mention'd in the foregoing Paragraph, there are beſides theſe Arteries, others anſwering to and accompanying the Veins called *Omphalo-meſentericæ*, above-mention'd.

Their uſe. Blood and Vital Spirit are not carried by them from the Mother to the *Fœtus*, as many, from *Galen*, have taught; but on the contrary, Spirituous blood is driven from the *Fœtus*, by the beating of its Heart, to the *Placenta* and the Membranes for their refection and nouriſhment; from which what blood remains, circulates back again in the Umbilical Vein together with the *Succus nutritius* afreſh imbibed by its capillaries diſperſed in the *Placenta*. But beſides Arterial blood, there flows out of the Navel by them part of the *Succus nutritius* that was imported by the Umbilical Vein, namely that of it which is more craſs and terrene, which by one circulation through the Heart (or it may be many) could not be changed into blood: this part I ſay flows out by theſe Arteries, which by their branches that are diſperſed through the *Amnios* diſimbogue it by their little Mouths into it; for what uſe, ſhall be declared preſently.

How the veſſels paſs through the Membranes. And here I ſhall tranſcribe a material Objection with the Anſwer to it, out of *Diemerbroeck*. *Obj.* "How can theſe Veſſels (Vein and Arte-"ries)

"ries) when they have grown from the Belly of "the *Fœtus* to that length as to reach the Mem-"branes, penetrate and paſs through them to the "*Placenta?* *Anſw.* This is done in the ſame "manner as the roots of Herbs, Shrubs and Trees "penetrate into the hard Ground, yea often into "thick Planks, Walls and Stones, (which water "cannot enter) and root themſelves firmly in "them. For juſt ſo the firſt ſharp-pointed and "moſt fine ends of the Umbilical Veſſels in-"ſinuate themſelves by little and little into the "pores of the Membranes, (for the figuration "of thoſe pores are fitted for their entrance) "and paſs through them, and yet the liquors "contained in theſe Membranes cannot flow out "by them: and when thoſe Veſſels inhering in "the pores grow more out into length, by lit-"tle and little the ſaid pores are more and more "widened, (according to the encreaſe of the "Veſſels) and are inſeparably united unto and "grow in them.

Urachus. The fourth Umbilical Veſſel is the *Urachus* or Urinary Veſſel. This is a ſmall, membranous, round Pipe, endued with a very ſtrait Cavity, ariſing from the bottom of the Bladder up to the Navel, out of which it paſſes along within the common cover, and opens into the *Allantoides.* It is more apparently pervious in many of the larger Brutes than it is in Man, in whom ſome have denied it any Cavity: but that it is hollow in him, is confirmed by many Hiſtories of perſons adult, who having the ordinary Urinary paſſage along the *Penis* ſtopt, the paſſage in this Veſſel has been unlocked, and they have made water by the Navel, which could not have been imagin'd to have happen'd, if it had been originally a Ligament without any *Meatus*. *Bartholin* and others have affirmed that the *Urachus* in Men reaches no further than the Navel; How then comes that humour into the *Allantoides* that has perfectly the ſame taſte with the Urine in the Bladder? But their Errour ſprung from hence, that they thought an humane *Fœtus* had no *Allantoides*, and that humour that is found in it, they thought had been contained in the *Chorion*. But this is in ſhort refuted above, but more fully and accurately by Dr. *Needham*, *lib. de formato Fœtu*, *cap.* 3. As to the perviouſneſs of the *Urachus* I ſhall add this further, That in Abortions of five or ſix Months old, the Bladder of the *Embryo* is always full of Urine, out of which if in the following Months it ſhould not be emptied by the *Urachus*, the Bladder would ſoon burſt, ſeeing there is daily ſome *Serum* ſeparated from the blood in the Kidneys, and ſent to the Bladder; and the more the *Fœtus* encreaſes, the more muſt needs be ſeparated. Yea Dr. *Needham* affirms, that one may either preſs the liquor contained in the *Allantoides* by the *Urachus* into the Bladder, or with a Pipe blow wind out of the Bladder by the ſame way into the *Allantoides*.

Its uſe. Its *uſe* has been ſufficiently declared in the preceding Paragraph; as alſo above, when we delivered the uſe of the *Allantoides*, which we ſhall not repeat.

Funiculus. Theſe four Veſſels (as has been ſaid above) have one *common cover*, which alſo keeps each of them from touching other. It is called *Inteſtinulum*, and *Funiculus* (by which it with its Veſſels is ſometimes underſtood.) It is membranous, round and hollow, indifferent thick, conſiſting of a double coat, (the inner from the *Peritonæum*, and the outer from the *Panniculus carnoſus*.) Sometimes it ſelf only is wreath'd about like a Rope, the Veſſels included in it running ſtreight along its Cavity; and ſometimes they are wreathed together with it.

Its knots. It has ſeveral *knots* upon it here and there, which Dr. *Wharton* thinks to be *Papillæ* or little Glands through which the lacteal (or nutritious juice) diſtils out of the capacity of the *Funiculus* into the Cavity of the *Amnios*. I cannot tell whether this be ſo or no; but that uſe that doting Midwives make of them, to gueſs by their number how many Children more the Mother ſhall have, and by their colour, whether thoſe Children ſhall be Male or Female, is moſt ridiculous and ſuperſtitious.

How to tye the Navel-ſtring and cut it off. When the Infant is born, this Navel-rope is uſed to be tyed, about one or two fingers breadth from the Navel, with a ſtrong thread caſt about it ſeveral times, and then about two or three fingers breadth beyond the Ligature to be cut off. What is not cut off, is ſuffered to remain till it drop off of its own accord. Which the longer or ſhorter while it is a doing, the longer or ſhorter liv'd, Women propheſie the Children will be.

Of the nutrition of the Fœtus. There have been great Diſputes among both Philoſophers and Phyſicians, with what, and by what way the *fœtus* is nouriſhed. Some affirm by blood only, and that received by the Umbilical Vein; others by Chyle only, received in by the Mouth: each of which are in an extream. The truth is, according to the different degrees of perfection that an *Ovum* paſſes from a Conception to a *fœtus* ready for the birth, it is nouriſhed diverſly.

Firſt, by appoſition.

For firſt, as ſoon as an *Ovum* impregnated is deſcended into the Womb, it preſently imbibes through its outer Membrane ſome of that albugineous liquor that at this time plentifully bedews the internal Superficies of the *Uterus*; ſo that as ſoon as the firſt Lineaments of an *Embryo* begin to be drawn out of that humour contained in the *Amnios*, they preſently receive encreaſe by the appoſition of the ſaid liquor filtrated out of the *Chorion* through the *Amnios* into its Cavity. And this ſame liquor that thus encreaſeth the firſt rudiments of the *Embryo*, is called by Dr. *Harvey Colliquamentum.* That this way of nutrition or augmentation of the *Embryo* is poſſible, need not be doubted by him that conſiders that the *fœtus* of a Sow have no other poſſible way of being nouriſhed till ſhe is near half gone with Pig: “ for even till then, ſaith Dr. *Needham*, the *Cho-*
“ *rion* cleaves not to the Womb, but look as ma-
“ ny *fœtus* as there are, there are ſo many Eggs
“ as it were without Shells, neither ſticking to
“ the Womb nor to one other; but when one
“ opens the Matrix, they all tumble out of their
“ own accord. There are no Glandules, no
“ *Placenta.* But the *Chorion* which is ſoft and
“ porous, does like a Sponge imbibe or ſuck up
“ the ſerous liquor that ſweats out of the inmoſt
“ Membrane of the *Uterus*, to be afterwards
“ ſwallowed by the Veins, (I ſuppoſe he means the Mouths of the Umbilical Vein, after the ſaid Vein is ſo perfectly formed as to receive it.) But of this more in the beginning of the foregoing Chapter.

2. By the Umbilical Vein.

But when the parts of the *Embryo* begin to be a little more perfect, and the *Chorion* becomes ſo denſe that not any more of the ſaid liquor is imbibed by it, the Umbilical Veſſels begin to be formed, and to extend to the ſide of the *Amnios*, which they penetrate, and both the Vein and Arteries paſs alſo through the *Allantoides* and *Chorion*, and are implanted into the *Placenta*, that at this time, firſt gathering upon the *Chorion*, joyns it to the *Uterus*. And now the Hypogaſtrick and Spermatick Arteries, that before ſpued out the nutritious juice into the Cavity of the *Uterus*, open by their Orifices into the *Placenta*, where (whether by meer percolation through it, or by ſome ſort of fermentation alſo, I will not determine, but) they depoſite the ſaid juice, which is abſorbed by the Umbilical Vein, and by it conveyed firſt to the Liver, then to the Heart of the *fœtus*, where the thinner and more ſpirituous part of it is turned into blood. But the more groſs and terrene part of it deſcending by the *Aorta* enters the Umbilical Arteries, and by thoſe branches of them that run through the *Amnios*, is diſcharged into its Cavity. They that will laugh at this paſſage of the nutritious juice, becauſe it is made by this doctrine to chooſe its way, as if it were ſome animal or even rational Creature, let them avoid the like treatment if they can, while they deliver that the Chyle paſſes immediately either from the Meſentery, the *Receptaculum*, or *Ductus communis* to the *Placenta*, when a *fœtus* is in the Womb. 'Pray how ſhould the Chyle know, or the Lacteals, by which it paſſes, that there is any *fœtus* in the Womb, that the one ſhould offer to go that way, and the other give it way to go thither at that time, whereas the paſſage is ſhut at all other times? yet this my Opponents maintain. As alſo how comes the Chyle preſently to turn its courſe after the *Fœtus* is born, and inſtead of deſcending to the *Uterus*, aſcend to the Breaſts? What mechanical cauſe can be aſſigned to theſe and many other the like *Phænomena*? We muſt therefore be content to reſolve ſome things into the admirable and unintelligible diſpoſal of our wiſe Creator.

But there lies another Objection againſt this Opinion, Becauſe it allows none of the Mother's blood to be received by the *Fœtus* through the Umbilical Vein, but only *Succus nutritius*; how ſhould Blood be firſt bred in the *Fœtus*, ſeeing it has Blood before the Liver or Heart, or any other part that conduce to Sanguification, are in a capacity to perform their office?

I confeſs it is inexplicable by me how Blood ſhould be made ſo ſoon; but that it may be and is made, out of the *Succus nutritius* or *Colliquamentum*, without the mixture of any from the Mother, is apparent from the moſt accurate Obſervations of Dr. *Harvey*, concerning the order of the generation of the parts in a Chicken, (which from firſt to laſt receives nothing from the Hen.) Says he, * "there appears at the "very firſt a red leaping *Punctum* or Speck, a "beating Bladder, and Fibres drawn from thence "containing Blood in them. And as much as "one can diſcern by accurate inſpection, Blood is "made, before the leaping Speck is formed; "and the ſame is endued with vital heat, before "it is ſtirred by the Pulſe: and as the pulſation "begins in the Blood and from it; ſo at length "at the point of death it ends in it. —— And

* De generat. Animal. Exercit. 51.

“ becauſe the beating Bladder and the ſanguine- “ ous Fibres that are produced from it, appear “ firſt of all ; I ſhould think it conſentaneous to “ reaſon,that the Blood be before its receptacles; “ namely the content before its container ; and “ that this is made for the ſake of the other. He confeſſes it to be a *Paradox*, that Blood ſhould be made and moved, and endued with vital ſpirit before any ſanguifying or motive Organs are in being ; and that the Body ſhould be nouriſhed and encreaſed, before the Organs appointed for concoction (namely the Stomach and Bowels) are formed : but neither of theſe are greater Paradoxes than that there ſhould be ſenſe and motion in the *Fœtus* before the Brain is compoſed ; and yet, ſays he, “ the *Fœtus* moves, con- “ tracts, and ſtretches out it ſelf, when there is “ nothing conſpicuous for a Brain but clear wa- “ ter. I ſay, if all theſe unlikely things do certainly come to paſs in an Egg, that has nothing to ſet the vegetative, or vital principle thereof on work, but the warmth of the Hen that ſits upon it ; why ſhould we think it ſtrange that nutritious juice impregnated with the vital ſpirits of the arterial Blood, with which it circulated through the Mother's Heart (it may be more than once) ſhould be turned into Blood in an humane *Fœtus* (foſtered with ſuch kindly warmth in the Womb) though it neither receive any humour under the form of Blood from the Mother, nor have it ſelf as yet any Organs of ſanguification ſo perfect as to perform their office? But to proceed.

* Exercit. 57.

3. *By the mouth.*

The groſſer nutritious juice being depoſited by the Umbilical Arteries in the *Amnios*, as ſoon as the Mouth, Gullet, and Stomach, &c. are formed ſo perfectly that the *Fœtus* can ſwallow, it ſucks in ſome of the ſaid juice, which deſcending into the Stomach and Inteſtins is received by the *Venæ lacteæ*, as in adult perſons.

That the *Fœtus* is nouriſhed this way, *Diemerbroeck* evinces by theſe Reaſons.

" 1. Becauſe the Stomach of the *Fœtus* is never " empty, but is found poſſeſt of a milky whitiſh " liquor; and ſuch like is contained even in its " Mouth.

" 2. Becauſe there are *Fæces* contained in the " Inteſtins, (which Philoſophers call *Meconium*) " which the Infant as ſoon as 'tis born voids by " ſtool. Without doubt theſe are the excrements " of ſome aliment taken in by the Mouth.

" 3. Becauſe the Stomach could not preſently " after the birth perform the function of con- " coction, if it had not at all been accuſtomed " to it in the Womb.

His fourth Reaſon, ſuppoſing the *Fœtus* to be nouriſhed in part by the Mother's Blood, I ſhall not recite, becauſe I think that to be an erroneous Opinion, as I think to make appear by and by.

" 5. Becauſe the Infant as ſoon as it is born " knows how to ſuck the Breaſt, which it could " not be ſuppoſed to be ſo dextrous at, if while " it remained in the Womb it had taken nothing " by ſuction.

" 6. Becauſe many Infants as ſoon as they are " born, before they have ſucked any Breaſt, or " taken any thing by the Mouth, vomit up a " milky aliment: which therefore muſt needs be " received into their Stomach in the Womb. This he gives an inſtance of in one of his own Children.

The Fœtus *is not nouriſhed at all by the Mother's blood.*

Theſe Arguments I think ſufficient to prove what they are alledged for; but when he would afterwards prove that the *Fœtus* is alſo nouriſhed by the Mother's Blood conveyed by the Umbilical Vein, I think his Reaſons are invalid. For he ſays it muſt be ſo, *firſt*, becauſe the ſaid Vein is implanted into the *Placenta*; (but this is but begging the Queſtion, for 'tis neceſſary it ſhould be implanted into it though it receive nothing from it but nutritious juice.) *Secondly*, becauſe of the great quantity of Blood that will iſſue out of the Umbilical Vein, if one tye the Navel-rope and then open the ſaid Vein betwixt the Ligature and *Placenta*: for he ſays there will flow out four times as much Blood as could be ſuppoſed to be contained in the ſmall Arteries on that ſide the Ligature next the *Placenta*. I anſwer, that firſt one would be well ſatisfied that the Ligature was made ſo ſtrait, that there could no Blood paſs through it from the *Fœtus* to the *Placenta*. And ſecondly, it cannot exactly be gueſſed how much Blood may be contained in the *Fœtus*'s Arteries in the *Placenta*, ſo as that one ſhould be certain that there does four times more flow out by the Vein. But laſtly, ſuppoſe there do four times as much more blood iſſue out of the Vein as is contained in the *Fœtus*'s Arteries that are on that ſide the Ligature next the *Placenta*, and this blood come from the Dam's Hypogaſtrick and Spermatick Arteries; I ſay there will not only four times, but forty times as much iſſue therefrom, for all the blood of the Dam might then be drawn out this way. Wherefore I think this Experiment makes much more againſt his Opinion than for it. His *third* Reaſon is the neceſſity of it; becauſe as the *fœtus* encreaſes, it needs much aliment, and its weak Bowels can concoct but little, it muſt therefore have ſome purer aliment, and which is already concocted (he means blood) to nouriſh it, and by its commixture to help forward the changing the aliment received by the Mouth into blood. *Anſw.* This reaſon himſelf invalidates in the next Paragraph, * where he confeſſes that the *Fœtus* in the Womb is nouriſhed in the ſame manner as the Chicken in an Egg, which receives encreaſe firſt by the *inner* White (as he diſtinguiſhes) by way of appoſition; Secondly, it receives nouriſhment in by the Mouth from the *outer* White, and at the ſame time its Umbilical Veſſels enter the Yelk (to draw nouriſhment from thence) which, he ſays indeed, reſembles the Mother's blood; but ſeeing it has not the leaſt form of blood, why would it not be more plauſibly ſaid that it is inſtead of the *Succus nutritius* that the *Fœtus* in viviparous Animals receives by the Navel-vein? And ſeeing theſe ſeveral Liquors are turned, part of them, into blood in a Chicken, without any of the Hen's blood to *ferment* them (as he ſpeaks;) why ſhould not the ſame power be granted to the vegetative or animal ſoul of the *Fœtus* in the Womb, without any aſſiſtance from the Mother's blood? To which I ſhall add another Argument (out of Dr. *Harvey*) taken from Cæſarean births, when living Infants are cut out of the Mother's Womb, after ſhe is dead. For if it had its life and heat from the Mother's blood; ſurely it ſhould dye as ſoon as ſhe at leaſt, if not ſooner: for when death approaches, the ſubordinate parts do languiſh and grow cold before the principal; and therefore the Heart fails laſt of all. Wherefore the blood of the

* Anat. corp. hum. p. 367.

the *Fœtus* would firſt loſe its heat, and become unfit for its office, if it were derived from the Mother's Womb; ſeeing her Womb is deſtitute of all vital heat, before her Heart. But enough of this.

The reaſon why Women with Child want their Menſes.

But ſome may object, if the *Fœtus* be nouriſhed by none of the Mother's blood, why ſhould her *Menſes* be ſtopt all or moſt of the while ſhe is with Child? To which I anſwer, that 'tis for the ſame reaſon that Nurſes that give ſuck commonly want them alſo; for as in Nurſes the chyle paſſes in a great proportion to the Breaſts, whereby the blood being defrauded of its due and wonted ſhare does not encreaſe to that degree as to need to be leſſened by the flowing of the *Menſes*; ſo in Women with Child, there is ſo great a quantity of the *Succus nutritius* (which is only Chyle a little refined and impregnated with vital ſpirit) that paſſes to the *Placenta* by the Hypogaſtrick and Spermatick Arteries for the nouriſhment of the *Fœtus*, that unleſs the Mother be very ſanguine, her *Menſes* intermit after the firſt or ſecond Month.

I ſhall conclude therefore, that the *Fœtus* is nouriſhed three ſeveral ways, but only by one humour: firſt by appoſition of it whiles it is yet an imperfect *Embryo* and has not the Umbilical Veſſels formed; but after theſe are perfected, it then receives the ſame nutritious juice by the Umbilical Vein, the more ſpirituous and thin part whereof it tranſmutes into blood, and ſends forth the groſſer part by the Umbilical Artery into the *Amnios*, which the *Fœtus* ſucks in at its Mouth, (after the parts of the Mouth, the *Gula*, Ventricle, *&c.* are formed ſufficiently for ſuch an action) and undergoing a new concoction in its Stomach is received out of the Inteſtins by the *Venæ lacteæ*, as is done after the birth.

CHAP. XXXIV.

What parts of a Fœtus *in the Womb differ from thoſe of an adult perſon.*

HAving delivered the Hiſtory of the *Fœtus*, we will only further ſhew in what Parts a *Fœtus* in the Womb differs from an adult perſon. And this we cannot do more exactly than in the manner that *Diemerbroeck* has reckon'd them, whom therefore we ſhall here tranſlate, with little alteration.

This diverſity, he ſaith, conſiſts in the difference of magnitude, figure, ſituation, number, uſe, colour, cavity, hardneſs, motion, excrements, and ſtrength of the Parts.

Now this diverſity is conſpicuous either in the whole Body, or in the ſeveral Ventricles, or in the Limbs.

There is conſiderable in the whole Body,

1. The littleneſs of all the parts.
2. The reddiſh colour of the whole.
3. The ſoftneſs of the Bones; whereof many are as yet griſtly and flexible, and that by ſo much the more, by how much the *fœtus* is further from maturity.

In the Head there are ſeveral differences. As

1. The Head in reſpect to the proportion of the reſt of the Body is bigger, and the ſhape of the Face leſs comely.

2. The bones of the Scull are ſofter, and the Crown is not covered with bone, but only with a Membrane.

3. The bone of the Forehead is divided, as alſo that of the under-Jaw: and the *Os cuneiforme* is divided into four.

4. The bone of the *Occiput* or hinder part of the Head is diſtinguiſht into three, four or five bones.

5. The Brain is ſofter and more fluid, and the Nerves very ſoft.

6. The bones that ſerve the ſenſe of Hearing are wonderfully hard and big.

7. The Teeth lye hid in the little holes of the Jaw-bone.

8. There is no leſs diverſity in the *Thorax*. For,

1. The Dugs ſwell, and out of them in Infants new-born whether Male or Female, a ſerous Milk iſſues forth ſometimes of its own accord, ſometimes with a light preſſure: yet there are no Glandules very conſpicuous, but there is ſome faſhion of a Nipple.

2. The *Vertebræ* of the Back want their ſpinous proceſſes, and are each one made of three diſtinct Bones, whoſe mutual concourſe form that hole whereby the ſpinal marrow deſcends.

3. The Heart is remarkably big, and its *Auriculæ* large.

4. There are two unions of the greater Veſſels, that are not conſpicuous in adult perſons: *viz.* 1. The *Foramen ovale*, by which there is a paſſage open out of the *Cava* into the *Vena pulmonaris*, juſt as each of them are opening the firſt into the right Ventricle, and the latter into the left Ventricle of the Heart. And this *Foramen* juſt as it opens into the *Vena pulmonaris* has a Valve that [illegible]

hinders any thing from returning out of the ſaid Vein into the *Foramen.* 2. The *Canalis arterioſus*, which two fingers breadth from the *baſis* of the Heart joyns the *Arteria pulmonaris* to the *Aorta.* It has a pretty large Cavity, and aſcends a little obliquely from the ſaid Artery to the *Aorta*, into which it conveys the blood that was driven into the pulmonary Artery out of the right Ventricle of the Heart, ſo that it never comes in the left Ventricle; even as that blood that is ſent out of the left Ventricle into the *Aorta* never came in the right, (except a little that is returned from the nutrition of the Lungs) but paſſed immediately into it out of the *Vena cava* by the *Foramen ovale.* So that the blood paſſes not through both the Ventricles as it does after the *fœtus* is born; for then it muſt have had its courſe through the Lungs, which it cannot have, becauſe they are now very denſe and lye idle and unmoved. Yea they are ſo denſe and heavy that if one throw them into water they will ſink; whereas if the *fœtus* be but born and take only half a dozen breaths, they become ſo ſpongy and light that they will ſwim. Which (by the way) may be of good uſe to diſcover whether thoſe Infants that are killed by Whores, and which they commonly affirm were ſtill-born, were really ſo or no. For if they were ſtill-born, the Lungs will ſink; but if alive, (ſo as to breath never ſo little a while) they will ſwim.

4. The Gland *Thymus* is notably large, and conſiſts as it were of three Glands.

In the lower belly there are theſe differences.

1. The Umbilical Veſſels go out of the *Abdomen.*

2. The Stomach is narrower, yet not empty, but pretty full of a whitiſh liquor.

3. The Caul is hardly diſcernible, being almoſt like a Spider's-web.

4. The Guts are ſeven times longer (or more) than the Body.

5. In the ſmall Guts the Excrements are pituitous and yellow, but in the thick ſomewhat hard and blackiſh, ſometimes greeniſh: the *Cæcum* is larger than uſual, and often filled with *fæces.*

6. The Liver is very large, filling not only the right Hypochondre, but extends it ſelf into the left ſide, and covers all the upper part of the Stomach. It has a paſſage now more than in the adult called *Canalis venoſus*, which ariſing out of the *Sinus* of the *Porta* carries the greateſt part of what is brought by the Umbilical Vein directly and in a full ſtream into the *Cava* above the Liver; but as ſoon as the Infant is born, and nothing comes any longer by the ſaid Vein, this *Canalis* preſently cloſes, as the Vein it ſelf turns to a Ligament; as alſo do the *Urachus* and the two Umbilical Arteries.

7. The Spleen is ſmall.

8. The Gall-bladder is full of yellow or green Choler.

9. The Sweet-bread is very large and white.

10. The Kidneys are bigger and unequal in their ſuperficies, and look as if they were compounded of a collection of very many Glandules.

11. The *Renes ſuccenturiati* are exceeding large; they do not only border upon the Kidneys, as in the adult, but lye upon them and embrace their upper part with a large *Sinus* as it were.

12. The Ureters are wide, and the Bladder diſtended with Urine,

13. In Females the *Uterus* is depreſſed, the *Tubæ* long, and the *Teſtes* very large.

The difference in the Limbs conſiſts,

1. In the tenderneſs and ſoftneſs of the Bones.

2. The little bones of the Wriſt and Inſtep are griſtly and not firmly joyned together.

CHAP. XXXV.

Of the Birth.

THE *Fœtus* ſwimming in the liquor of the *Amnios*, and the Navel-rope being ſo long, it muſt needs have ſcope enough to change its ſituation, and that is the reaſon that Anatomiſts differ ſo much about it. But according to Doctor *Harvey* its uſual poſture is thus.

The poſture of the Fœtus *in the Womb.*

"Its Knees are drawn up to the Belly, its Legs "bending backwards, its Feet acroſs, and its "Hands lifted up to its Head, one of which it "holds to the Temple or Ear, the other to the "Check; where there are white ſpots on the "Skin as if it had been rubb'd upon. The Back-"bone turns round, the Head hanging down "towards its Knees. Its Head is upwards, and "its Face commonly towards the Mother's "Back.

At its birth.

But towards the birth (ſometimes a week or two before) it alters its ſituation, and tumbles down with its Head to the neck of the Womb, with its Feet upwards. Then the Womb alſo ſettles downwards and its Orifice relaxes and opens. And the *Fœtus* being now ill at eaſe ſprawls and moves it ſelf this way and that way, whereby it tears the Membranes wherein it is included, ſo that the Waters (as they call them) flow into the *Vagina*, which they make ſlippery for the eaſier egreſs of the Infant: though ſometimes the Membranes burſt not but come forth whole, (as they do commonly in Brutes.) At the ſame time the neighbouring parts are looſened and become fit for diſtention: the joyntings of the *Os ſacrum* and *Pecten* with the *Coxendix*, as alſo of the *Oſſa pubis* are ſo relaxed, that they yield very much to the paſſage of the *Fœtus*. And its motion gives that diſturbance to the *Uterus*, that preſently the animal ſpirits are ſent plentifully by the Nerves to its conſtrictory Fibres, and the Muſcles of the *Abdomen*, which all contracting together, very ſtrongly expel the *Fœtus*, which (in the moſt natural birth) goes with the Head foremoſt: and if the Feet or any other part (beſides the Head) do offer it ſelf firſt, the travail is always more painful and dangerous.

The term of going with Child. The ſeveral ſorts of Creatures have ſundry terms of going with young; The ſtated and moſt uſual time of Women is nine Months; though ſome bring forth ſome Weeks ſooner and others later. But when it is given out that perfect and ſprightly Infants are born at ſeven Months end; it is either to hide the faults of ſome new-married Woman, or from the miſtake of the ignorant Mother. As alſo when ſometimes the Mother has affirmed her ſelf to go eleven Months or upwards, it is either through miſtake, or to keep faſt ſome fair Eſtate, when the pretended Father's dead without an Heir, for which the cunning Widow plays an after-game.

The reaſon of the birth. Divers reaſons are given why the *Fœtus* at the ſtated time of birth is impatient of ſtaying any longer

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Tab.

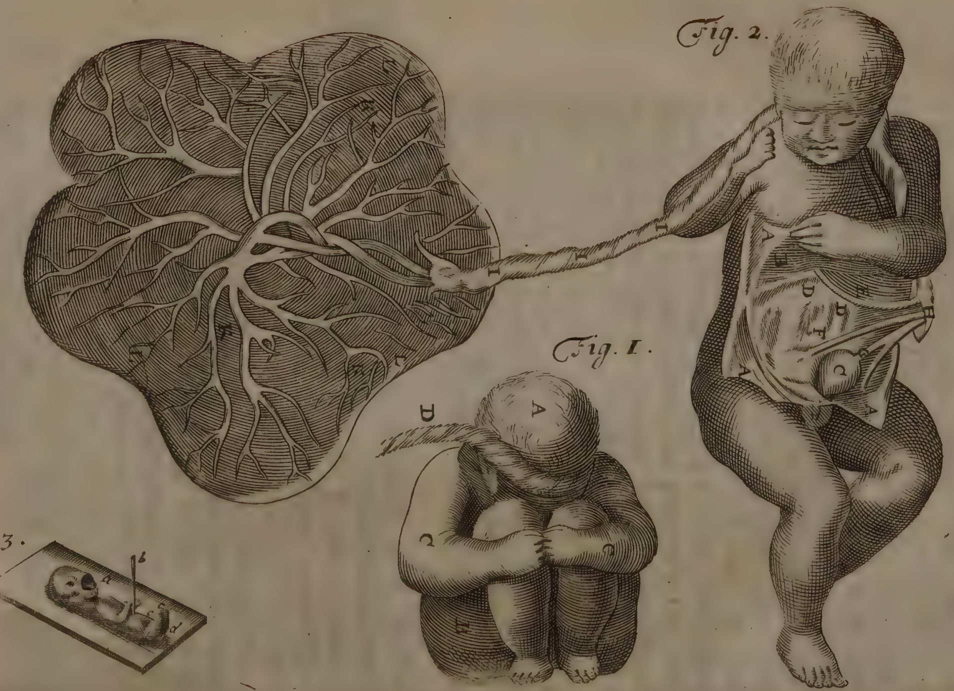


Fig. 3.

longer in the Womb. As the narrowneſs of the place, the corruption of its aliment, or the defect of it, the too great redundance of excrements in the *Fœtus*, and the neceſſity of ventilation or breathing. All theſe are plauſibly defended by their ſeveral Authors. But without blaming ingenious Men for exerciſing their Wits on ſuch a Subject, we chooſe however rather to be content with reſolving all into the wiſe diſpoſal of the great Creatour, whoſe Power and Wiſdom were not more eminent in creating Man at firſt out of the Duſt of the Earth, than out of thoſe principles and in that method whereby he is produced in ordinary generation.

Tab. X.

Fig. I. Repreſenteth the uſual ſituation of the *Fœtus* in the Womb.

A *Its Head hanging down forwards, ſo that its Noſe is hid betwixt its Knees.*
BB *Its Buttocks, to which its Heels cloſe.*
CC *Its Arms.*
D *The Umbilical rope paſſing by its Neck, and wound round over its Forehead.*

Fig. II. Sheweth the *Fœtus* taken out of the Womb, and as yet tyed to the *Placenta*, the Umbilical Veſſels being ſeparated at their riſe.

AAA *The* Abdomen *opened.*
B *The Liver of the* Fœtus.
C *The Urinary Bladder.*
DD *The Inteſtins.*
E *The Umbilical Vein.*

FF *The Umbilical Arteries.*
G *The* Urachus.
H *The Umbilical Veſſels united and inveſted in their common Coat.*
I *The* Funiculus umbilicalis *reaching to the* Placenta.
KKKK *The Veins and Arteries diſperſed through the* Placenta.
LLL *The* Placenta *of the Womb.*

Fig. III. Sheweth an *Embryo* in its juſt dimenſion, (communicated to me by Dr. *E. Tyſon.*)

a *Its wide Mouth with the Tongue in it.*
b *The Umbilical rope.*
c *The Thighs and Legs, with the* Coccyx d *appearing like a Tail.*

The End of the Firſt Book.

The

The Second Book.

OF THE MIDDLE CAVITY, CALLED THORAX.

CHAP. I.

Of the common containing parts of the Thorax *or Breaſt.*

The Breaſt.

HItherto of the loweſt Cavity or *Abdomen*, and of the parts contained in it, whether appointed for *Chylification* (and in ſome reſpect for *Sanguification*) or for *Procreation*. Now it followeth that we deſcribe the middle Cavity, called *Thorax*, which containeth the Organs of Reſpiration, and thoſe that elaborate the Blood and Vital Spirits, with the trunks of the Veſſels whereby theſe are diſtributed into all the parts of the Body, for their refection, and the preſervation of their natural heat.

Its bounds. This Cavity is bounded above by the *Clavicula* or Chanel-bones, below by the Diaphragm or Midriff, (whereby it is ſevered from the *Abdomen*;) in the fore-part by the Breaſt-bone and Cartilages; in the Sides by the Ribs; behind by the *Vertebræ* of the back.

Figure. The *figure* of it is in a manner Oval, ſomewhat flat before and behind, whereas in Beaſts it is ſomewhat ſharp: So that only Man lieth on his Back.

Parts. The *parts* whereof it is compoſed, are either *containing*, or *contained.* The parts *containing* are either *common*, or *proper*.

The common containing parts. The *common containing parts* are in number five, viz. *Cuticula*, *Cutis*, *Pinguedo*, *Membrana carnoſa*, and the common Membrane of the Muſcles. Of which having at large diſcourſed in Book I. Ch. 3. when we treated of the *common containing parts* of the lower Belly, we ſhall not here repeat what is there delivered, but paſs on to the *proper*.

CHAP. II.

Of the proper containing parts; and firſt, of the Dugs.

The proper containing parts. THE *proper containing parts* are either *external*, or *internal*. The *external* are in number three, the Breaſts, the Muſcles, and the Bones. The *internal* proper containing parts are three in like manner; the *Pleura*, the *Mediaſtinum*, and the Diaphragm.

The Paps;

Dugs are granted to both Sexes, and are ſeated in the middle of the *Thorax*, on each ſide one, upon the pectoral Muſcle that draweth the Shoulder forwards.

1. Of Men.

In Men they are framed of the *Cutis*, the *Membrana carnoſa*, Fat, and the Nipple, and ſerve only for beauty, and are called *Mammillæ.*

2. Of Women.

In Women, beſides theſe parts, they have remarkable Veſſels, Glandules, and Pipes to contain the Milk ſeparated by the Glandules, and are called *Mammæ.*

Their bigneſs.

They differ much as to their bigneſs in ſeveral Women, and in the ſame Woman in regard of age and other circumſtances: for before they have their *Menſes*, and when they are very old, they bunch out but very little. And in the middle or flower of their age, when they give ſuck, or are with Child, they are bigger than at other times.

Glands.

They are made up of many *glandulous* bodies of a different bigneſs, and are not of one continued glandulous ſubſtance, (as Dr. *Wharton* affirmeth, *lib. de Gland. p.* 236.) There is one Gland in the middle juſt under the Nipple that is bigger than the reſt. The ſpaces between the Glands are filled up with fat, and there are abundance of Veſſels that go from one to another. They are all incloſed by the *Membrana carnoſa*, and make up as it were an half globe. They are whiter of ſubſtance in Women than in Brutes. Through theſe Glands the Milk is ſeparated from the Blood, being nothing but the Chyle iſſuing out of the left Ventricle of the Heart with the Blood, (to which it is not as yet aſſimilated) and driven hither along the Thoracick Arteries. Unleſs we will admit *Venæ la-*

cteæ to come hither, which Opinion we ſhall examine afterwards.

Papilla.

Upon the middle great Gland ſtandeth the *Papilla* or Nipple, which is round and of a ſpongy ſubſtance, covered with a very thin Skin, and has many little holes in it for the Milk to diſtil out by, when the Child ſucketh it. It is of an exquiſite ſenſe, and reſembles ſomething the *Glans* of a Man's *Penis*, in that by handling or ſucking, it becomes erect or ſtiff, being otherwiſe commonly flaggy. It is red in Virgins, livid in thoſe that give ſuck, and blackiſh in old Women. All the *Tubuli lactiferi* or Milk-conduits end in it.

Its bigneſs.

It differs in *bigneſs*, being as big in ſome as a Mulberry, in others as a Raſpberry, in others leſs: when Women give ſuck, it is longer than at other times.

Uſe.

Its *uſe* is, to be like a Pipe or Tunnel, through which the Child (taking it in its Mouth) may ſuck the Milk out of the Breaſt: And it is of exquiſite ſenſe, that the Milk paſſing through it may cauſe a kind of titillation, whereby Mothers and Nurſes may take the greater delight and pleaſure to ſuckle their Infants.

Areola.

There is a little circle that ſurrounds it called *Areola*, which in Virgins is pale and knotty; in thoſe that are with Child or give ſuck, brown; and in old Women, black.

Their Veſſels.

The Breaſts have all ſorts of Veſſels, Veins, Arteries, Nerves, Lympheducts, which are common to them with other parts; and *Tubuli lactiferi* proper to themſelves, and according to ſome, *Venæ lacteæ*. Of all theſe in order.

Veins.

The *Veins* are of two ſorts, for ſome are *external*, ſome *internal*. The *external* ſpring from the *Axillar* branch, and run only under the Skin which covereth the Breaſts, and are called *Thoracicæ ſuperiores*, or the uppermoſt Breaſt-veins. And theſe are they that look ſo blue in the Breaſts of fine-skin'd Women. The *internal*, called *Mammariæ*, ſpring from the *Rami ſubclavii*: They are in number two, on each ſide one. Theſe enter in among the Glands of the *Mammæ*, where they ſend forth a great many branches; but deſcending thence by the *Mucronata cartilago*, they paſs out of the Breaſt, and go downward under the *Muſculi Recti*. When they are come almoſt to the Umbilical region, they are ſaid to be joyned by ſundry inoſculations with the *Venæ epigaſtricæ*, which meet them there; though moſt late Anatomiſts deny any ſuch inoſculation.

Theſe *Venæ epigaſtricæ* ſpring from the external *Ramus iliacus*, and by a ſtreight way paſs upward under the aforeſaid Muſcles. And from the internal branch of the ſaid *Ramus* ſpring the *Venæ hypogaſtricæ*, which are inſerted into the neck and bottom of the Matrix. Of which in Book I. when we treated of the Womb.

Arteries.

They have the ſame number of *Arteries* as *Veins*, and of the ſame denomination, *viz.* *Arteriæ thoracicæ ſuperiores* which are ſent forth from the *Axillar*, and *Arteriæ mammariæ* in like manner which ſpring from the Subclavian, and from the Breaſts deſcend to about the Navel. Whither when they are come, they are ſaid (but erroneouſly) to be united by inoſculation with the *Arteriæ Epigaſtricæ* aſcending. This inoſculation being rejected, principally, becauſe it is oppoſite to the circulation of the blood, ſeeing the blood in the deſcending Arteries runs a courſe direct contrary to that which is contained in the aſcending; Dr. *Highmore* ſuggeſts, "that the Mammary Arteries do not inoſculate with the Epigaſtrick Arteries, but with the Epigaſtrick "Veins, and accordingly the Mammary Veins "with the Epigaſtrick Arteries: Whence ſuppoſing (according to the old Opinion) that "Milk is made of blood, he thinks he has found "a ready way whereby the blood may paſs to "the Womb in pregnant Women for the nouriſhment of the *Fœtus*, and whereby it may "aſcend to the Breaſts in Nurſes. For by the "Epigaſtrick Arteries, he ſays, blood is derived "from the Iliack branches, and conſequently "from the Womb to the Mammary Veins, ſo "that that blood which in thoſe that do not give "ſuck, or are not with Child, uſes to ſtagnate "about the Veſſels of the Womb, or to be evacuated by the *Menſes*, does in thoſe that give "ſuck aſcend by the Epigaſtrick Arteries to the "Breaſts, which it cauſes to ſwell, and is turnned into Milk: And on the contrary, when "the Child is weaned, that blood which uſed "to be carried to the Breaſts by the Mammary "and Epigaſtrick Arteries, is conveyed to the "Womb and evacuated monthly.] And for the confirmation of his Opinion, in his Tab. 17. he gives a Scheme of ſuch inoſculation, as if he had really obſerved it in his tracing theſe Veſſels. But not to mention, that it is contrary to truth, that Milk is made of blood; later Anatomiſts have wholly rejected any Anaſtomoſis of Veins and Arteries with one another; ſo that his Hypotheſis which is built thereupon, falls to the ground. As for the true uſe of both Veins and Arteries, that ſhall be ſhewn by and by when we come to the *uſe* of the Breaſts. They

Nerves. They have *Nerves* (according to *Spigelius*) from the fourth Vertebral pair of the *Thorax*, which about the middle of the Rib, perforating the Intercoſtal Muſcle, is divided into four branches, which are ſent afterward to the pectoral Muſcle, and ſo into the Breaſts, the thickeſt paſſing to the Nipple. Dr. *Needham* ſays, that they have ſeveral Nerves from the Axillary: And ſuppoſes from their many Nerves, that ſome ſpirituous juice is brought unto the Breaſts by them, which being mixt with the nutritious maſs endows it with a nutritive vertue; or perhaps it ſupplies a ferment for the ſeparation thereof from the blood. But I believe they ſerve only for the more exquiſite ſenſation, that Nurſes may take the greater delight in giving their Children ſuck.

Lymphe-ducts. They have very many *Lymphe-ducts*. Dr. *Wharton* ſaith, they are very conſpicuous and numerous in the *Ubera* of Cows, but one can hardly trace them into the *Parenchyma*. Wherefore (ſaith he) 'tis likely that they carry back all the exhalations reſolved into ſweat by help of the Membranes——which they rather miniſter to than to the *Parenchyma*. But this is contrary to the now received Opinion, that the Lymphe-ducts receive their *Lympha* only by the mediation of Glands.

Tubuli lactiferi. Beſides theſe four ſorts of Veſſels that are common to them with moſt other parts of the Body; they have proper to themſelves certain *lactiferous* (or milk-carrying) *Pipes*, which are the Store-houſes wherein the Milk is reſerved, and through which as by Conduits it flows to the Nipple when the Child ſucks. *Bartholin* has obſerved ten or more of them, full of Milk in Women giving ſuck, with their outer ends encompaſſing the *Papilla* circular-wiſe, each of which as they paſs further into the Breaſts, are divided into ſundry branches, which end in the Mammary Glands (above ſpoken of) from whence they bring the Milk, and diſcharge it through the pores of the *Papilla*.

Venæ lacteæ.

The ſeveral branches of theſe *Tubuli* amongſt the Glands many do take for true Lacteals, and therefore do believe that there are ſome *Venæ lacteæ* that conduct the Chyle directly to the *Mammæ*. But from whence thoſe Lacteals have their Origin, is not agreed among the Defenders of that Opinion. Some affirm them to riſe from the Stomach, ſome from the *Receptaculum chyli*, ſome from the *Ductus thoracicus*, and ſome from the *Womb*. The truth is, it is no wonder they ſhould not agree concerning their riſe, ſeeing the Opinion is grounded more upon rational conjecture, than ocular diſcovery; though ſome of each of theſe Opinions have pretended it. For, as was ſaid in the former Book (Chap. 32.) diſcourſing of the *Venæ lacteæ* their being ſaid to convey the liquor into the *Amnios*, That that were a plauſible Opinion, if ſuch could be demonſtrated by Anatomy; ſo we may ſay as to their conveying the Chyle to the Breaſts, where it comes to be called Milk. But with all due reſpect and deference to the Eſpouſers of this Hypotheſis, (ſuch as the moſt learned Sir *George Ent*, *Caſpar Martianus*, *Diemerbroeck*, &c.) we muſt crave leave to diſſent therefrom (with *Steno*, Dr. *Wharton*, Dr. *Needham*, &c.) till there ſhall be obſerved more certain footſteps of ſuch Veſſels.

Ductus adipoſi.

From the great quantity of Fat that is collected in the Breaſts, *Malpighius* contends for another ſort of Veſſel beſides all the foregoing, namely *Ductus adipoſi*; and believes that the fat here has a nobler uſe than to fill up the Interſtices of the Glands ſo as to make the Breaſts round and plump, namely that therefrom iſſues at leaſt all the buttery part of the milk. It cannot be denied but that Fat and Butter are very much of the ſame nature: but it ſeems not ſo probable, that Nature ſhould ſeparate the oily or fatty particles from the Chyle, to the end only that they may be mixed with the ſame again, and ſo iſſue under one form out of the body; but granting that the ſame matter out of which fat is generated, is an ingredient in the milky maſs, I am inclin'd to believe that both the ſerous, caſeous, and butyrous particles of the milk continue in one anothers embraces through all the ways by which they paſs from their firſt entrance into the *Lacteæ* to their *exit* by the *Papilla*.

The uſe of the Mammæ.

The *uſe* of the Breaſts in Women is to prepare or ſeparate Milk for the nouriſhment of the Child. Which how it is done, we ſhall ſhew in as few words as may be.

It was an old Opinion that Milk was made of blood ſent from the Womb by the Epigaſtrick Veſſels aſcending, and as was thought inoſculating with thoſe branches of the *Mammariæ* that deſcend towards the Navel. But as later Anatomiſts have found thoſe Anaſtomoſes only imaginary (invented to ſerve an Hypotheſis;) ſo it is generally denied that blood either ſent from the Womb, or from whereſoever, is the true matter out of which Milk is made. For not to mention (which yet is very conſiderable) that it is incredible that the Mother could every day endure the loſs of ſo much blood (ſuppoſe a pound and half) as the Child ſucks daily Milk from the Breaſts; I think the Argument urged by Dr. *Wharton* may ſatisfie any man, *viz.* " Nature does " nothing in vain; ſhe goes not forward and " backward by the ſame path. But if ſhe make " blood of Chyle (*which is certain)* and then make " Chyle of blood again, ſhe goes ſo. For Chyle " is a ſort of Milk, as appears by the opening of " the Lacteal veins. If therefore that Chyle be " firſt excocted into blood, and then return again " to the nature of Milk, Nature ſhould certainly " fruſtrate her firſt work.] We ſhall not therefore ſpend further time to refute ſo improbable (and now obſolete) an Opinion; but ſhall avow, that Chyle is the true matter out of which Milk is made, which is done after this manner.

How Milk is made. The Chyle being received into the common receptacle from the *Venæ lacteæ* of the Meſentery, aſcends up by the *Ductus thoracicus*, and by it is conveyed into the ſubclavian Veins, where it is mixed with the blood, and from whence it is circulated with it through the ventricles of the Heart. And when it comes out of the left ventricle by the *Aorta*, a good part of it (as yet not aſſimilated to the blood) is ſent to the Breaſts by the Mammary and Thoracick Arteries, whoſe Capillaries are inſerted into the Glands through which it is ſtrained or filtrated into the *Tubuli lactiferi*, even as the *Serum* of the blood is ſeparated from *it* by the Glands of the Kidneys into their *Tubuli* or *Siphons*. And as thoſe *Siphons* of the Kidneys carry the *Serum* into the *Pelvis*, ſo do theſe of the *Mammæ*, the Milk into the common Duct of the Nipple. As for the blood that came along with the Chyle to the Glands, that returns back again into the Subclavian and Axillar Veins, and ſo to the Heart.

Beſides this matter of the Milk (*viz.* Chyle) Dr. *Wharton* (ſuitable to his Hypotheſis of the *Succus nutritius* of the Nerves) thinks that the Nerves contribute their ſhare, which he calls Spermatick, for the nouriſhment and encreaſe of the Spermatick parts of the Child. But if it ſhould be ſuppoſed that the Nerves have ſuch *Succus* in them (which we do not believe) what weakneſs muſt it needs induce upon the Mother to have ſo much of it (with the Animal Spirits) daily drain'd out of them? whereas we ſee that many Women are more chearful and healthful when they give ſuck, than at other times. We cannot therefore conſent to that Opinion.

And here a moſt difficult Queſtion may ariſe, why the Chyle (whether it be brought by ſome *Venæ lacteæ*, or by the Arteries) flows only to the Breaſts at ſome certain times, and not always, ſeeing the Veſſels that carry it are not obliterated, nor it ſelf exhauſted.

Why it flows to the Breaſts at ſome times onely.

They that taught, that the Milk was made of blood, and that that blood was derived from the Womb by the Hypogaſtrick veſſels into the Epigaſtrick, which latter they believed to inoſculate with the Mammary; theſe I ſay deriving the Milk from the Menſtrual blood as its matter out of which it is made, thought that the ſtopping of the *Menſes* (as commonly happens to Nurſes, unleſs very plethorick) occaſioned the regurgitation of the blood by the ſaid Veſſels up to the Breaſts, where ſo free a vent was found for it, after it was firſt changed into Milk by their

Glandules. They aſſigned the ſame blood for the nouriſhment of the *Fœtus* in the Womb, and thought that after the birth it aſcended up to the Breaſts. But having in the former Book (Ch.33.) ſhewn that the *Fœtus* is not nouriſhed at all by the Mother's blood, as alſo in this Chapter that Milk is not made of it; we need not (though it were eaſie to) ſhew how ill this Hypotheſis would ſatisfie the Queſtion, if blood ſhould be ſuppoſed the matter out of which Milk is made. And indeed it is far eaſier to invalidate the Reaſons that have been urged for it, than to draw any from the new that are more ſatisfactory. So that as above in (Book I.) diſcourſing of the manner and matter of the nouriſhing the *Fœtus* in the Womb, we ſcrupled not to expoſe our ſelves to the Smiles of our ſo over-ſagacious *Virtuoſi*, in reſolving all into the wiſe diſpoſal of the Creatour; ſo we ſhall not be aſhamed to profeſs our (I think invincible) ignorance here alſo, without giving this Queſtion any other Reſolution, than that it is ſo, becauſe Providence has order'd it ſo to be. However we will not omit to give *Diemerbroeck*'s Opinion, which if it cannot ſatisfie, may for its ingenioufneſs delight.

" The cauſe of it (ſays he) is a *ſtrong imagi-*
" *nation*, or an intenſe and often thinking of
" Milk, Breaſts, and their Suction, which work-
" eth wonderful things in our Bodies: not in-
" deed ſimply of it ſelf, but by mediation of the
" appetitive power, or of the paſſions of the
" Mind, which induce various motions on the
" Spirits and Humours. So the imagination and
" thinking of a great danger maketh a man
" tremble, fall, be cold, fall into a ſwoon, yea

" hath ſometimes turn'd his Hair grey in a ſhort " time: The imagination of a joyful matter " cauſeth heat and animoſity of the Body; think" ing on a ſhameful thing, or a view of it, cau" ſeth bluſhing; thinking on a terrible thing, " paleneſs; on a ſad thing, cold. Luſtful thoughts " make the Body hot, relax the ſtrict Genitals " of Women, erect the *Penis*, and do ſo open the " ſeminary ways that are otherwiſe inviſible, that " Seed iſſueth out of its own accord in involunta" ry or nocturnal pollution. The ſame intenſe " imagination (*adds he*) and a deſirous cogita" tion of ſuckling the Infant, is the Cauſe that " the Chyliferous Veſſels (*by which he means* Venæ lacteæ *properly ſo called*) " are looſened and " opened towards the Breaſts, eſpecially if ſome " outward Cauſes tending that way favour and " further incite that ſtrong imagination, as wan" ton handling of the Breaſts, the moving of the " *Fœtus* in the Womb, the ſucking of the *Papilla*, " &c. For according to the different influx of " the Animal Spirits, the parts are ſometimes " ſtraitned, ſometimes relaxed, as every one " knows; and according to that different con" ſtriction or relaxation the blood and other im" pelled humours, flow ſometimes more, ſome" times leſs into the parts; and ſometimes beget " heat, ſoftneſs, redneſs; ſometimes conſtriction, " cold, and paleneſs. Amongſt theſe impelled " humours is the Chyle, *&c.*———] To confirm this Opinion, he gives ſeveral Inſtances wherein nothing but imagination could move the Chyle to tend to the Breaſts. His firſt is that known Story of *Santorellus*; " That a poor " man's Wife dying, and not having means e" nough to hire a Nurſe for the Infant ſhe had

" left behind her, he uſed, (to ſtill it a little) " often to lay it to his Paps, (without doubt " (ſays *Diemerbroeck*) with a great deſire to " yield it ſome Milk) and ſo at length by that " intenſe and continual thought, and often re- " peated ſucking of the *Papillæ*, his Breaſts af- " forded Milk enough for the ſuckling the In- " fant. (Which by the way ſeems to make much againſt his Opinion of the Chyle's being conveyed to the *Mammæ* by the *Venæ lacteæ*; for ſeeing Men according to Nature give no ſuck, to what purpoſe ſhould *Venæ lacteæ* be diſtributed to their *Mammillæ*? and yet here is an inſtance of a man giving ſuck, and therefore the Chyle is more likely to be brought by the Arteries, which Men have as well as Women; unleſs we will grant that force to imagination, to make *Venæ lacteæ* as well as to ſend the Chyle by them, which would be an equal force of imagination to imagine. But to proceed.) He tells another Story of an old Woman that came to give ſuck, and he delivers it with ſuch Circumſtances as may create a belief of the truth of it.

" At *Vyanen* a Town not far from us (*viz*, " from *Utrecht*, in which Province it is) about " thirty years ago there was an Hoſteſs that kept " the Bore's-head Inne without the Gate, who " was brought to Bed a little after her Husband's " death, and died in Child-bed, or very ſoon af- " ter, leaving a healthful Child behind her: " and having left very little Eſtate, her Mother " whoſe name was *Joan Vuyltuyt*, being alſo poor " and not able to put it out to Nurſe, yet had " ſuch pity on her Daughters Child, as to un- " dertake to Nurſe it, and ſhe was now three- " ſcore and ſix years old. Now having ſome-

" times uſed, with the greateſt commiſeration, " to hold it to her Breaſts when it cried, and of" fered it the Nipple to ſuck; by that ſtrong " imagination, and deſirous cogitation of nurſing " the Infant, her Breaſts begun to give Milk, and " that in a few days ſo plentifully, as was abun" dantly ſufficient to feed the Child, ſo that it " had ſcarce any need of other Suſtenance; and " ſo, to the admiration of all, the Infant was " well nouriſhed with the Milk of this old Wo" man, whoſe Breaſts for many years had been " wither'd and flaggy, but now became plump " and full like a young Woman's. There are " many ſtill alive in that City that remember the " thing very well.] I confeſs the Story is very odd, but whether to be reſolved into the force of imagination, I leave the Curious to meditate. However he very plauſibly anſwers ſeveral Objections that may be made againſt it, which it will be worth the while for the Latin Reader to peruſe, in his *Anat. corp. human. lib.* 2. *cap.* 2. *p.* 409, 411, *&c.*

The two other *external* proper containing parts of the *Thorax* are the *Muſcles* and the *Bones*. But of theſe we ſhall omit the deſcription here, having thought it more convenient to treat of all the *Muſcles*, and all the bones of the whole Body in two diſtinct Books, *viz.* of the *Muſcles* in the *fifth*, and of the *Bones* in the *ſixth*: And as for theſe of the *Thorax* in particular, the *Muſcles* are deſcribed in Chap 15. of B. V. and the *Bones* in Chap. 11,12,13. of B. VI.

CHAP.

CHAP. III.

Of the internal proper containing Parts, viz. the Pleura, Mediaſtinum *and* Diaphragm.

THE *internal* proper containing parts are in number three, the *Pleura*, the *Mediaſtinum*, (with the *Thymus* growing to it) and the *Diaphragm.*

Pleura. The *Pleura* hath its denomination from the Ribs which it cloaths on their inſide, (for a Rib is in Greek called πλευρὰ) and ſo it may be termed in Engliſh, the *Coſtal membrane.*

Its ſubſtance. It is membranous, white, thin, and hard, reſembling the *Peritonæum*, and lining all the Cavity of the *Thorax.*

Spigelius de human. corp. fabr. lib. 9. cap. 3. will have it to be thicker and ſtronger than the *Peritonæum*, contrary to the Opinion of *Riolanus*, who affirmeth the *Peritonæum* to be the thicker and ſtronger, becauſe it is appointed for ſuſtaining the weight of the Guts.

Parts. It conſiſts of a double Membrane, of which the inner, or that next the cavity, is thickeſt. This is ſmooth on its inſide, and bedewed with a wateriſh humour, that the Lungs might play againſt it without any prejudice. Sometimes on one ſide, and ſometimes on both, it ſends forth (on its inſide) certain nervous Fibres (even in healthful perſons) which being inſerted into the inveſting Membrane of the Lungs do ſo fix them in their place, as to hinder that liberty of aſcent and deſcent in reſpiration which is natural to them, and yet many times without any notable injury to their breathing. Though ſometimes (as *Spigelius* has obſerved) they tye the Lungs ſo very cloſe to the ſides, as to cauſe a continual and incurable *Dyſpnœa.* As to that wateriſh humour that bedews the inſide of this Membrane, it ſeems to proceed from vapours raiſed from the blood, and condenſed by the (comparative) coldneſs of this Membrane. The outer Membrane is thinner, and rough on its outer ſurface, that it might cleave the more firmly to the Ribs and Muſcles by the intervention of their proper membrane.

Figure. As for its *figure*; without, it is arched; within, hollow; above it is narrower, below broader, being chiefly widened ſide-ways.

Holes. Above, it is perforated in ſix or ſeven places, to give way to the *Vena cava* deſcending, and the *Aorta* aſcending, the *Gula*, the Wind-pipe, Lacteals, Lympheducts and Nerves. Below, where it covereth the Midriff, it is perforated in three places, to give way to the *Vena cava* aſcending, and the *Aorta* deſcending, as alſo to the *Gula.*

Riſe. It is ſaid to have its *riſe* from the Membranes covering the *Spinalis medulla*; however, it adheres very cloſe to the *Vertebræ* of the Back, from whence it comes forward on each hand by the ſides to the Breaſt-bone, under which the Membranes of each ſide are joyned together, and ſo becoming double it goes back again ſtreight from the middle of the Breaſt to the Back, dividing the cavity of the *Thorax* into two parts, like a partition-wall, and one Lobe of the Lungs from the other: and this is called *Mediaſtinum*, of which by and by.

Its

Veins. Its *Veins* ſpring from the ſuperiour Intercoſtal branch, and from the *Vena ſine pari.*

Arteries. The *Arteries* in like manner proceed from the ſuperiour Intercoſtals, (which ariſe from the Subclavian) and theſe deſcend to about the fourth Rib, below which it has its Arteries from the hinder part of the *Aorta* deſcending.

Nerves. It hath *Nerves* from twelve vertebral pair, *viz.* from all the pairs of the *Thorax*: for from betwixt each of the twelve *Vertebræ* of the Back there ſprings a pair of Nerves, and each is immediately divided into the *fore-* and *hinder-branches*: The *fore-branches* are they which ſerve the Intercoſtal Muſcles, external and internal, and alſo the *Pleura*: as for the *hinder*, they are beſtowed upon the Muſcles which lye on the Back, *&c.*

The Veins and Arteries according to *Spigelius* run between the two Membranes of the *Pleura*, and therefore he thinks that when an inflammation of the *Pleura* (called a Pleuriſie) impoſthumates, the matter is rather gathered betwixt its Membranes than betwixt the Intercoſtal muſcles and it.

Of the Mediaſtinum. The ſecond *internal* proper containing part is the *Mediaſtinum*; ſo called becauſe it ſtandeth in the middle of the Breaſt, and divideth its cavity into two partitions, *viz.* a right and left.

Its riſe. It ſpringeth from the Membranes of the *Pleura* meeting at the *Sternum*, (as was ſaid before;) ſo that at its riſe it conſiſts of four Membranes, becauſe the *Pleura*, of the duplicature whereof it is made, conſiſts of two. But as the *Mediaſtinum* tends from the *Sternum* through the middle of the *Thorax* towards the Back, its duplicated

Membranes are ſo ſevered, that the Heart with its *Pericardium* are contained in the cavity that is formed by their ſeparation. Yet when they arrive near the Back, they joyn one to another again as cloſe as they did at the Breaſt, though they preſently part again, (ſaith *Diemerbroeck*) and make another narrower Cavity, but as long, for the Gullet, &c. to deſcend by. Some have formerly imagined a third Cavity at its Origin under the *Sternum*, as in particular Dr. *Highmore*, who ſays the interſtice betwixt the Membranes is large, and yet (he ſays) they are knit to one another by certain Fibres. In this Cavity, he thinks, there are thick vapours and *flatus* ſometimes contain'd, which cauſe very acute pains there, by retching the membranes and violating the fibres that knit them together. But in truth there is no ſuch Cavity, nor conſequently any ſuch vapours, or pain depending thereupon. For though indeed, if the diſſection be begun at the *Sternum*, when one has pull'd it off from the *Mediaſtinum*, one would think at firſt ſight that there were as great a diſtance betwixt the Membranes of the *Mediaſtinum*, as the *Sternum* is broad; yet if one begin the Section at the Back, and looſe the Ribs there, and ſo come to the *Sternum*, he will ſee the *Pleura* doubled knit cloſe to the *Sternum* without any Cavity.

Subſtance.

The *ſubſtance* of it is like that of the *Pleura* from which it ſprings; only where it is parted, it is thinner and ſofter than the *Pleura*. The outer ſide towards the Lungs is ſmooth, but the interiour is rough, by reaſon of the fibres whereby it adheres to the *Pericardium* in ſome places, and by which its own two membranes at their meeting are united. It is ſometimes pretty well ſtored with fat eſpecially about its veſſels, ſomewhat like the Caul in the *Abdomen.*

Veins. Arteries. As for its Veſſels: *Veins* and *Arteries* it hath from thoſe called *Mammariæ internæ*, but ſmall; and *Veins* beſides from *Vena ſine pari.*

It hath moreover one ſpecial *Vein* called *Mediaſtina*, which ſpringeth from the lower ſide of the *Ramus ſubclavius.*

Nerves. The *Nerves* called *Phrenici*, and *Stomachici*, ſpringing from the ſixth pair (Dr. *Willis*'s eighth) deſcend betwixt its Membranes, and ſend forth ſmall twigs into it.

Lymphe-ducts. *Bartholin* ſays, it has *Lympheducts*, which riſing here and there in many Rivulets, enter the *Ductus thoracicus* at laſt in one channel. Theſe (he ſays) imbibe the water that is condenſed betwixt its duplicature, and convey it into the ſaid Duct.

Uſe. It hath three *uſes*: *Firſt*, it divideth the Breaſt and Lungs into two parts, that one part being wounded or any way hurt, the other might perform the office of reſpiration.

Secondly, It holdeth up the Heart incloſed in the *Pericardium* ſo, that it may not reſt upon the Back-bone, when we lye upon our Back; or fall upon the Breaſt-bone, when we bend our ſelves towards the ground; or touch the Ribs, when we lye upon our Sides.

Thirdly, It giveth a ſafe paſſage to the Veſſels which paſs by it, and holdeth up the Diaphragm ſo that it is not pulled too much down by the weight of the Bowels that hang by it, *viz.* the Liver and the Stomach.

Thymus. To the upper part of the *Mediaſtinum* at the Throat there groweth a glandulous body called *Thymus*, ſeated between the diviſions of the Subclavian Veins and Arteries. It is a whitiſh, (but lightly tinctur'd with blood) ſoft, ſpongy body, (in ſhape reſembling a Tyme-leaf, from which it has its name.) It is larger in Children and Women than in Men. In Infants it conſiſts of three Glands, and is in ſubſtance ſomething like the Sweet-bread; but in adult perſons it dries up and contracts into one continued ſubſtance. It has no proper Duct whereby any thing is conveyed into any peculiar cavity, and therefore is to be reputed in the number of conglobate Glands.

Its Veſſels. The Jugular *Veins* and *Arteries* paſs through it as they go up to the Neck, but if they ſend forth any twigs into it, they are ſo ſmall as not to be diſcovered in diſſecting it. Dr. *Wharton* ſays, it has *Nerves* from the ſixth pair (Dr. *Willis*'s eighth) and from the Subclavian *Plexus*, which depoſite their *Succus nutritius* in it, whoſe ſuperfluous or impurer parts are ſeparated from it in this Gland and conveyed away by the Lympheducts, and the refined liquor is reſumed by the Nerves diſperſed in it, for the uſe of the nervous parts of the whole Body. And becauſe he foreſaw how open this Opinion, (which himſelf calls *ſcrupoſa ſententia*) lay to the Objection, that it is very improbable that the Nerves ſhould bring the *Succus nutritius* to this part, and after depuration ſhould reſorb it; he anſwers, that either the Nerves muſt do it, or it cannot be done at all, ſeeing there are no other Veſſels fit for the reſuming of it. But he had better have ſuſpected his ſuppoſed office of the *Thymus*, when he ſaw himſelf ſo hard ſet to maintain it. For it is more probable that when there is found any whitiſh liquor in it, (as there is in Infants, and in Calves, *&c.*) that liquor is Chyle which is brought thither by Lacteals, and deſcends from thence into the Subclavian Veins; ſeeing if one kill a Calf about two hours after it has been plentifully ſuckled, the *Thymus* abounds with this juice, as *Diemerbroeck* affirms; who alſo denies that there are any perceptible Nerves inſerted into it, but grants Lympheducts, which empty themſelves into the Subclavian Vein.

Uſe. Its *uſes* are, firſt, to prop and ſtrengthen the diviſions of the Veſſels, namely of the *Vena cava* and aſcending *Aorta*; and ſecondly, to defend them from compreſſion by the *Claviculæ*, in ſtooping forward. In adult perſons it ſeems to be of little other uſe; but in Infants, in whom it is larger, and has liquor like Chyle in it, it ſeems to contribute ſomething towards the refining or depuration of it.

The Diaphragm. The third and laſt *internal* proper containing part is the *Midriff* or *Diaphragm* (derived ἀπὸ τοῦ διαφράττειν, *to diſtinguiſh*, becauſe it divides the trunk of the Body into two Ventricles, the *Abdomen* and *Thorax.*) It is alſo called φρὴν or φρένες, the *mind*, becauſe when it is inflam'd or otherwiſe much diſtempered, the Mind and Senſes are diſturbed, through the great conſent it has with the Brain, as being a very nervous part. The Latines call it *Septum tranſverſum* for the ſame reaſon as the Greeks call it *Diaphragma.*

Now this part being truly Muſcular, and aſſiſting reſpiration, we might on that account have deferred to treat of it till we come to deſcribe the Muſcles of the *Thorax*: but becauſe it is wholly an internal part, and ſerves to compoſe the cavity of the Breaſt, we rather chuſe to diſcourſe of it here, and omit it in the Treatiſe of Muſcles.

Its figure and ſituation.

It is almoſt round, (excepting its two appendages whereby it is faſtned to the *Vertebræ* of the Back and Loins) and is ſeated tranſverſly or acroſs the Body, only ſloping a little backwards. It is as broad as the width of the *Thorax*, for its edges are faſtned to the lower part of the *Sternum*, to the ends of the loweſt Ribs, and to the loweſt *Vertebra* of the *Thorax*.

Subſtance.

Its *ſubſtance*, as was ſaid but now, is muſcular, conſiſting of carnous and tendinous Fibres, like other Muſcles. But whereas it has conſtantly been deſcribed by all former Anatomiſts as one Muſcle, *Caſpar Bartholin* has demonſtrated it to conſiſt of two, an upper and a lower, (or a fore and an hinder) to which diſcovery he was partly directed by *Steno*'s Obſervations, who firſt queſtion'd the generally ſuppoſed Fabrick of this part.

It conſiſts of two Muſcles.

I ſay, it conſiſts of two Muſcles, an *upper* and a *lower*, which are thus deſcribed by the aforeſaid Author.

“ The *upper* Muſcle by one end, (*viz.* its head)
“ adheres circular-wiſe to the Ribs, and to the
“ *Appendix* of the *Sternum* ; the other paſſeth in-
“ to the *Tendon*, which makes the *nervous centre*
“ of the *Diaphragm* (as they call it) and is ſpent
“ on (or continued unto) the fleſh of the lower
“ Muſcle , and ſo the whole Midriff becomes
“ like one digaſtrick or double-bellied Muſcle.

Nay, the ſaid Author makes it a trigaſtrick one, inaſmuch as he has obſerved (in *Oxen*) that the fore-part of the upper Muſcle ſhoots forth a tendon to every baſtard Rib on each ſide the *Sternum*, to which Ribs the upper part of the tranſverſe Muſcles of the lower Belly alſo adheres, ſo that he thinks they are continued one into the other. Of what uſe he makes this union, ſhall be ſhewed in *Book* V. *chap.* 17. *Of the Muſcles of the Abdomen.*

" The *lower* ſprings from the *Vertebræ* of the " Loins, and neither proceeds from the other, " nor touches it but by the mediation of the " Tendon, (for though the Fibres of each Muſ- " cle ſeem ſometimes to mix a little one with an- " other on the under ſide, yet that is only by " mediation of each of their Tendons.) Thoſe " two *Appendices* (as they are called) of this low- " er Muſcle whereby it adheres to the *Vertebræ*, " have by all Anatomiſts been repreſented as if " they were of the ſame length; whereas indeed " they are not ſo, for the right is both longer " than the left, and very much exceeds it in the " number of carnous and tendinous Fibres. Yea " the right ariſes from (or rather terminates " into) the firſt, ſecond and third *Vertebræ* of " the Loins, as from ſo many heads; whereas " the left adheres to the laſt, and laſt but one of " the Back.

As to the courſe of the *Fibres* of both theſe Muſcles, becauſe they are better apprehended by the view than they can be by the deſcription, I ſhall wave this latter, and content my ſelf with exhibiting to the Eye of the Reader a Scheme of theſe Muſcles in *Tab.* 12. *Fig.* 2, & 3. from the ſaid Author.

Membranes. The upper ſide of the Midriff is cloathed with the *Pleura*, and its lower with the *Peritonæum*. To the upper membrane the *Mediaſtinum* and *Pericardium* are knit; and ſometimes the loweſt tips of the Lobes of the Lungs, but that connexion is preternatural.

It is perforated on the right hand in (or near) the Nervous centre by the Trunk of *Vena cava* aſcending from the Liver; and on the left hand a little more backwards, its lower Muſcle in its upper or fore-part (before it is become tendinous) is perforated by the Gullet and two Stomachick Nerves ſpringing from the *par vagum.* At which latter perforation the fabrick of the Diaphragm is remarkable; for there (as you may ſee in the foreſaid Figures) the Fibres which are next to the upper Orifice of the Stomach, run not ſtreight as in other parts of it, but crooked like a Bow, encompaſſing the ſaid Orifice, and by their contraction ſo conſtringing it, that the continual motion of the Diaphragm cauſes no regurgitation of any thing out of the Stomach, nor is the aſcent even of vapour permitted, except when it is violently burſt open by belching or vomiting. In the hinder part of this lower muſcle, *viz.* betwixt its two Appendages or productions whereby it is knit to the *Vertebræ*, there deſcend the *Aorta*, a branch of the *Vena azygos*, and the Intercoſtal Nerve (diſtinguiſh'd from the *par vagum* by Dr. *Willis*) for the uſe of the parts of the *Abdomen*. *Holes.*

It has been ſaid to have two *Arteries*, called *Phrenicæ*, from the *Aorta* deſcending, and as many *Veins* from the Trunk of *Vena cava* aſcending through it. But the above-mentioned *Bartholin* ſays, that the lower muſcle has peculiar Blood-veſſels. “For beſides thoſe Veins that ſpring “from the *Cava*, (which provide for the upper “Muſcle and middle part of the lower) this “lower has on each ſide peculiar and notable “ones which ariſe from the *Vena adipoſa*, to “which as many Arteries anſwer in like manner *Veſſels.*

"ſpringing from the *Lumbares*, yet at a different "Origin from thoſe other that accompany the "above-mentioned Veins that ſpring from the "*Cava.*] It has a peculiar *Nerve* which ſprings from the *brachial Nerves* with a double or triple Root; namely two or three ſlips, proceeding from the aforeſaid Nerves, grow into one trunk, which is the *Nerve* of the *Diaphragm*. The firſt and chiefeſt ſlip is produced from the ſecond vertebral Nerve; and the trunk that is made up of all the three, deſcends down the Neck and through the cavity of the *Thorax* without any ramification as far as the Midriff, where being divided again into two or three ſlips, on each ſide it is inſerted into its fleſhy or muſcular part. Now becauſe the Intercoſtal pair, according to Dr. *Willis*, has communication with the Vertebral from whence this Nerve of the Diaphragm ſpringeth, yea with this Nerve it ſelf, (for he ſays that two or three Nerves are ſent from the cervical *Plexus* of the Intercoſtal into the Trunk it ſelf of the Nerve of the Diaphragm) that learned Author very ingeniouſly gives a reaſon of the great conſent of the Midriff with the Heart, Brain and Face, when a man laughs. "For, "*ſays he*, as often as the imagination is affected "with ſome pleaſant or wonderful conceit, the "Heart would preſently fain triumph (*ovare*) "and be lighten'd by throwing off its burthen as "it were: wherefore that the blood may the "quicklier be emptied out of its right Ventricle "into the Lungs, and conſequently out of the "left into the *Aorta*, the Diaphragm being inſtigated by the Nerves that go to it from the "aboveſaid *Plexus*, is drawn upwards with a "more rapid *Syſtole*, and often repeating its

" jumps as it were, it bears up the Lungs, and " cauſes them the quicker and frequenter to diſ" charge the Air and Blood: and then inaſmuch " as the ſame Intercoſtal Nerve, that communi" cates below with the Nerve of the Diaphragm, " is alſo continued above with the Maxillar " Nerves, when a cackling is begun in the Breaſt, " the geſtures of the Mouth and Face pathetical" ly anſwer thereto.] And when the Diaphragm is wounded in its Nervous part, then the muſcles of the Face ſuffer Convulſions, and the laughter called *Riſus Sardonius* (which is involuntary) is cauſed. Beſides the abovesaid peculiar Nerve, it has *ſecondly* ſmall twigs from the Stomachick Nerves and Intercoſtal as they deſcend through it.

Uſe. Its *uſe* is *firſt* to divide the *Thorax* from the *Abdomen*, that noiſom and impure Vapours may not aſcend from the more ignoble parts (as the Guts) to offend the more noble (as the Heart, *&c.*) *Secondly*, to help the muſcles of the *Abdomen* in excluding the Excrements, and (in Women) the *Fœtus*. But *thirdly*, its chief Uſe is to aſſiſt reſpiration, in which, as * *Steno* obſerves, " it ſelf rather becomes leſs convex than its com" paſs contracted. For, *ſays he*, all the lines which " you pleaſe to conceive from the *Vertebræ* to the " reſt of its circumference, both when it is re" laxed, and when it is ſtretched out and be" comes ſtiff, are crooked in ſome part of them, " looking towards the *Thorax* with their convex " ſide, and towards the *Abdomen* with their con" cave. Theſe lines the leſs they are extended, " the more convex they are; whereby the *Abdo*" *men* is ſo much the larger, and the *Thorax* the " ſtraiter: and the more they are contracted, by ſo

*De Muſc. & gland. p. 11, 12.

“ ſo much the Surface of the Diaphragm is the “ leſs convex; whereby the *Thorax* is ſo much “ the larger, and the *Abdomen* the ſtraiter. “ And ſo the bottom of the *Thorax*, (*viz.* the “ Diaphragm) in inſpiration is more depreſſed, “ but in expiration aſcends.] Thus far *Steno*, to whom (the often mentioned) *Bartholin* aſſents, who ſays, “ that its firſt motion is per“ formed downwards, which the Lungs following, “ draw in the Air; and by and by it is moved “ upward, whence the Lungs being compreſſed, “ the Air with the Vapours that are mixt with “ it are excluded. So that from a convex laxity “ it comes to plainneſs (in inſpiration) but is “ not at all extended. Notwithſtanding in ex“ piration (which *Diemerbroeck* has well obſer“ ved) it is firſt of all ſtretched as it were with “ violence, but it is preſently relaxed again, and “ by drawing the Ribs together with that tenſi“ on it begins expiration with ſome force, and “ then the Ribs following it, its tenſion, pre“ ſently ceaſes, and it becomes lax. Which “ procedure *Diemerbroeck* illuſtrates with a pret“ ty and pat ſimilitude, when he affirms it to be “ done in the ſame manner as when Bells are “ rung with long Ropes; in which action the “ Rope is firſt ſtretch'd with violence; but be“ cauſe the Bell doth preſently follow that vio“ lence, hence the Rope forthwith becomes lax, “ until the Bell being turn'd about to the other “ ſide, the Ringer do again ſtretch the Rope “ with the like violence, and draw it back again.] At length *Bartholin* concludes, “ When the Dia“ phragm is compreſſed into the *Abdomen* (in “ inſpiration) the *Thorax* is elevated, otherwiſe “ than others think, who ſuppoſe the depreſſion

" of the Diaphragm to cauſe a depreſſion of the
" *Thorax*. But in expiration the Diaphragm be-
" ing driven upwards, the Breaſt is contracted;
" the Breaſt being contracted preſſes the included
" Air, the Air the Surface of the Lungs, that
" the Air may be driven from the *Veſiculæ* into
" the branches of the *Trachea*, whither as ſoon
" as it is come, the rings of the *Trachea* are con-
" tracted by the intermediate Fibres, and drive
" forth all the Air; and on this manner does
" Reſpiration proceed; all the Cells of the
" Lungs being fill'd again by and by in Inſpi-
" ration.

The nature of its motion.

Its *motion* ſeems to be a kind of mixt motion, but rather *Animal* than *Natural*: for though we move it in our ſleep, and ſo it may ſeem natural, yet ſeeing when awake we can ſtop, ſlacken, or haſten its motion as we pleaſe, it ſeems to be voluntary or animal.

And thus much of the parts *containing*, now to the parts *contained*.

CHAP. IV.

Of the Pericardium, *and the Humour contained in it.*

THE *Parts contained* are either *Viſcera* or *Vaſa*, Bowels or Veſſels.

Pericardium.

The *Bowels* are the *Heart* and *Lungs*. But the Heart being incloſed in a membranous cover, called *Pericardium*, we will firſt treat of *it*, in this Chapter.

Its name. It is called *Pericardium*, becauſe it is placed περὶ τ̃ καρδίαν *about the Heart.* It is called alſo *Capſula cordis*, the Heart-caſe, and *involucrum* the Cover, *&c.*

Subſtance and figure. It is membranous, and encompaſſeth the whole Heart, whoſe ſhape it therefore reſembles, but is larger, both to grant a free motion to the Heart, and to contain its proper liquor.

Origin. It ſprings at the Baſis of the Heart from the outer common Coats (that are borrowed of the *Pleura*) of thoſe Veſſels that enter into the Heart.

Holes, Whence it has *five holes* according to the number of Veſſels that go in or out of the Heart. As firſt one made by the aſcending Trunk of the *Cava*, another by the deſcending, both which enter the right Ventricle of the Heart, from whence there goes out *Vena arterioſa* into the Lungs, which makes a third hole. A fourth is made by the *Arteria venoſa* entring the left Ventricle of the Heart, and a fifth by the *Arteria magna* going out of the ſame.

Connexion. Its outſide *adheres* to the *Mediaſtinum* by many Fibres, and is continued to it at the baſis of the Heart, where the Veſſels perforate it. Its lower end is knit firmly to the centre or nervous part of the Diaphragm, which (*Bartholin* ſays) is peculiar to Men, for in all other Creatures it hangs looſe.

Veſſels. It has *Veins* below from the *Phrenicæ*, above from the *Axillares*. Its *Arteries* are ſo ſmall that they can hardly be diſcover'd. It receives *Nerves* from the eighth pair (heretofore reckon'd for the ſixth.) Dr. *Willis* ſays, " It has a great many " twigs of Nerves from that *plexus* of the *par vagum* that is over againſt the firſt or ſecond

“ Rib, and that it has ſo many for this reaſon, “ *viz.* That ſeeing it is appointed for a defence “ to the Heart, as often as any offenſive matter “ invades or beſets it (ſelf), it may be able to “ contract it ſelf and ſhake off its enemy: for it “ is likely that *tremors* and *inordinate vibrations* of “ the Heart, which in truth do manifeſtly differ “ from its *natural pulſe*, do proceed from the vio- “ lent ſucculſion of this Membrane.] *Bartholin* affirms it to have *Lymphedučts* alſo; which is very probable, that they may abſorb part of the liquor contained in it, leſt it abound too much, ſeeing it receives continual ſupply: for I am not of opinion that this liquor is ſpued out of the Lympheducts, as *Steno* thinks, but that they rather imbibe it and convey it to the *Ductus thoracicus.*

Its liquor. It contains in it a *ſerous liquor*, that in healthful bodies is a little reddiſh, much like water wherein fleſh has been waſh'd. It is bred of Vapours exhaling from the Heart, which are ſtopt by this denſe Membrane, and condenſed into humour. Dr. *Lower* oppoſing this Opinion brings for Argument, that if it were collected this way, becauſe it would be continually a gathering, it would ſoon encreaſe ſo much that this *Capſula* could not hold it. But the aboveſaid *Lymphedučts* abſorbing what is ſuperfluous, waſh away this Objection; which if they did not, his own Opinion that it drops out of the Glands ſeated at the baſis of the Heart, would be liable to the ſame inconvenience. For ſuch diſtillation would be as continual as this condenſation is ſuppoſed to be. Naturally it is not in quantity above two ſpoonfuls, (though it differ much according to the temperament of the Party, the hot having a ſmaller, and the cold a larger quantity.) But in diſeaſed perſons it is ſometimes increaſed to half a pound, yea to a whole pound, as *Diemerbroeck* has oft obſerved. This is that liquor that is ſuppoſed to have flown from the Side of our Saviour when the Souldier pierced it with a Spear, for ſaith the Text (John 19. 34.) *There came forth blood and water.* Sometimes Worms have been obſerved to breed within this bag, and ſuch perſons, when they were alive, have been ſubject to palpitation of the Heart, and ſwoonings.

Their uſes. The *Pericardium* is ſome ſort of fence to the Heart, but it ſeems to be chiefly made for the ſake of the liquor it contains, which ſerves for the moiſtening of the Heart and making its Superficies ſlippery, that it may move more glibly.

CHAP. V.

Of the Heart, in general, and of the reaſon of its motion.

The Heart. THE *Heart* (in Latin *Cor*, in Greek *κῆρ*, or *κέαρ ἀ καίω*, to *burn*, becauſe it is the ſource of *vital heat)* is the principal Bowel of the whole Body, which no perfect Animal does want, nor can long ſurvive its Wounds. Vital ſpirit and natural heat are communicated from it to all the parts of the Body, though they are not ſo much owing to its ſubſtance as to the ebullition or accenſion of the Blood and Chyle in it; as ſhall be diſcourſed hereafter.

It is *ſeated* in the middle of the Breaſt, encompaſſed with the *Pericardium* and *Mediaſtinum*, its lower tip or *Mucro* bending a little to the left ſide. Neither its *Mucro* nor ſides are knit to any place, but it hangs looſe in its Caſe, only ſuſpended by the Veſſels that go in and out of its upper part or baſis, to which the *Pericardium* adheres. Its ſituation in Beaſts that feed upon Graſs is near the middle of the whole body, reckoning from the Head to the Tail; but in Man (and moſt carnivorous Animals which generally have ſhorter Necks than others) it is nearer the Head; whereof the learned Dr. *Lower* gives an ingenious reaſon. " Seeing, *ſays he*, the " trajection and diſtribution of the blood de- " pends wholly on the *Syſtole* of the Heart, and " that its liquor is not driven of its own nature " ſo readily into the upper parts as into Veſſels " eaven with it, or downwards into thoſe under it: " if the ſituation of the Heart had been further " from the Head, it muſt needs either have been " made ſtronger to caſt out its liquor with grea- " ter force; or elſe the Head would want its " due proportion of blood. But in Animals that " have a longer Neck, and which is extended " towards their Food as it were, the Heart is " ſeated as far from the Head as from the other " parts; and they find no inconvenience from " it, becauſe they feed with their Head for the " moſt part hanging down, and ſo the blood, as " it has farther to go to their Head than in others, " ſo it goes a plainer and often a ſteep way.

Its ſituation.

It has a firm, thick, denſe *ſubſtance*, thinner and ſofter in the right ſide, thicker and more denſe in the left, but moſt compact and hard at its tip; only on the left ſide of the tip it is thin, as

Subſtance.

as conſiſting moſtly of the concourſe of the inner and outer Membrane. Its *Parenchyma* is for the greateſt part made up of muſculary Fibres, ſo that it ſelf may truly be reputed a Muſcle.

Fibres. Its *Fibres* are a few of them ſtreight, but far more oblique. Both are inſerted into a Tendon that is ſpread over its baſis under the Auricles. Part of which Tendon at the egreſs of the *Aorta* in ſome Creatures becomes bony, as in a Stag, *&c.* On the outer Superficies of the right Ventricle there run a few ſlender Fibres ſtreight upwards, and are terminated in its baſis. In which alſo terminate the oblique ones next under theſe, aſcending from the left ſide towards the right, ſpiral-wiſe. The Fibres that lye under theſe, hold a clean contrary courſe. For they ariſe every where from the right ſide of the Heart, whence being carried obliquely towards the left, and having embraced each Ventricle of the Heart, they aſcend to the baſis of the left ſide ſpiral-wiſe as the other. But they run not all of them the whole length from the baſis to the cone; for then would the Heart be as broad or thick at the lower end as the upper: but ſome reach not above half way, others a little further, *&c.* and ſome to the very *Apex*. The Fibres of the left Ventricle differ not from thoſe of the right as to kind, only they are conſiderably ſtronger. Which they are for this reaſon, that whereas the right Ventricle only promotes the circulation of the blood through the Lungs, the left muſt caſt it forth with that force as that it may circulate through the whole Body.

The curious Reader may find a moſt accurate deſcription of theſe Fibres in Dr. *Lower*'s Treatiſe *de Corde*, whither I refer him; for, to inſiſt too long on ſuch minute ſimilar parts, would not be ſuitable to this Epitome of Anatomy. Though by a view of thoſe Figures that I have borrowed of Him, their ſtructure may be pretty plainly apprehended.

Figure. Its *ſhape* is like a Boy's Top (ſave that it is flattiſh behind) or a Pyramid turn'd topſie turvy; whence it is divided into its baſis, which is its broader part and upper; and into its cone or *apex*, or narrower and lower part, which ends in a tip or *mucro*.

Bigneſs. It is *bigger* in Men than in other Creatures, conſidering the proportion of their bodies. It is leſſer but more denſe in hot and bold men, than in the cold and cowardly. In adult perſons it is commonly ſix fingers breadth long, and four broad at the baſis.

Coat. Outwardly it is covered with a proper *Coat*, which is thin, but ſtrong and denſe, and very hard to ſeparate from it; it is the ſame with the outer Coat of the great Artery, as that which cloaths the Ventricles on the inſide is continued unto and common with that thin skin that covers the inſide of the Arteries like a *Cuticula*: and hence 'tis likely (ſays *Diemerbroeck*) that the Arteries borrow theſe Coats of the Heart, as the Nerves borrow their two Tunicles from the *Pia* and *Dura mater* of the Brain. Upon this Membrane that inveſts the Heart, there grows ſome hard fat about the baſis, which ſerves to moiſten it.

Veſſels. It is not nouriſhed by the blood or chyle that are received into its Ventricles, but by Veſſels running through its *Parenchyma*.

Arteries. Its *Arteries* are two, ſpringing out of the *Aorta* before it paſs out of the *Pericardium*, and are called *Coronariæ*, becauſe their Trunks do not preſently enter into the *Parenchyma* of the Heart, but fetching a circuit on its ſurface the better to branch out themſelves towards its cone, they encompaſs its baſis like a Diadem. And though at their riſe they turn one on one ſide and t'other on the other of the Heart, yet at their ends they meet again and inoſculate one with the other: ſo that if one inject any liquor into one, it will run into the other.

Veins. It has alſo two *Veins* called *Coronariæ*, which encompaſs its baſis in like manner, and communicate one with the other. Theſe receive and carry back the Arterial blood that remains from the nutrition of the Heart, and refund it into the *Cava* juſt at its entrance into the right Ventricle.

Nerves. Its *Nerves* do ariſe chiefly from the *Plexus cardiacus* of the *par vagum* or eighth pair, into which *plexus* many twigs do enter from the Intercoſtal. But a little below this *plexus*, after the recurrent Nerve has parted from the Trunk of the *par vagum*, the *par vagum* ſends forth on each ſide a notable branch; which being carried towards the Heart, and creeping along its baſis behind, meet one another, and in all their progreſs ſend forth twigs through the whole Surface of the Heart, eſpecially on its backſide: as thoſe branches which proceed from the *plexus cardiacus*, are diſperſed chiefly on its foreſide, as Dr. *Willis* affirmeth.

The cauſe of the motion of the Heart. Great controverſie hath been and ſtill is about the *motion* of the Heart, *whether* it depend on the influx of the animal ſpirits, *or* on the accenſion and dilatation of the blood in its Ventricles, *or* partly on one, partly on the other. Plauſible Arguments are produced on every ſide, but ſuch as rather tend to ſhew the ſhortneſs and inſufficiency of the contrary Opinions to ſolve this *Phænomenon*, than pretend to demonſtrate any certain reaſon of it. That the immediate Inſtruments of its motion are its Fibres, none can doubt; but what ſets theſe Fibres on work is all the queſtion. That it cannot be the Animal Spirits conveyed by the Nerves (*onely*) is apparent, *firſt*, becauſe the Heart moves in the *Embryo* before either Brain or Nerve are ſo perfectly formed, that the Animal Spirits can be elaborated out of the blood by the former, or tranſmitted to the Heart by the latter: yea ſeeing they are made of Arterial blood, that muſt be ſent to the Brain by the pulſation of the Heart before they can be generated. And *ſecondly*, becauſe the Heart of living *Fœtus*'s (as of young Puppies) and of Eels, being cut out of the body and from all the Nerves by which any Animal Spirits ſhould flow into it, will continue beating as long as 'tis warm: yea when it has ceas'd beating, if one throw warm blood or but warm water upon it, it will recover ſome kind of pulſation again. Which may ſerve alſo to convict the ſecond Opinion of Errour; for if its motion depended only on the dilatation or rarefaction of the blood, it would ceaſe as ſoon as the blood flows no longer into its Ventricles.

And for a further confutation of the ſecond Opinion, which ſuppoſes the accenſion (and conſequent dilatation) of the blood as the cauſe of this pulſation, Dr. *Lower*'s Experiment, or his Obſervation ſeem argumentative beyond contradiction. His *Experiment* is this; "He drew

" out of the *Jugular vein* of a Dog about half of " his blood away, injecting by turns into the " *Crural vein* a like quantity of Beer mixt with " a little Wine; and this he repeated alternatively ſo often, till inſtead of blood there " flow'd out of the Vein only a paler tincture " like water wherein Fleſh had been waſh'd, or " Claret diluted with very much water; and yet " the Heart in the mean time remitted but a little of its former pulſation. . . . . His *Obſervation*, which he had from a Phyſician worthy of credit, is this: " A Youth about ſixteen years " old, continuing bleeding for two days together, his Friends and thoſe that waited on " him, gave him good ſtore of Broth to keep " up and recruit his Spirits; which ſwallowing " down greedily, his bleeding was now and then " encreas'd thereby, ſo that at length having " poured forth almoſt the whole maſs of his " blood, that which now run out was dilute and " pale, neither of the nature nor colour of blood, " but liker the Broth he had drunk ſo much of: " and this kind of flux continued a day or two, " (the Heart the mean-while retaining its pulſation) till at length being ſtopt, the Youth " was reſtored by degrees to entire health, and " grew to a robuſt and luſty Fellow.] This Experiment and Obſervation, I ſay, do make it apparent, the motion of the Heart depends not on the accenſion and dilatation of the blood, for then when in the firſt the Beer and Wine, in the ſecond the Broth flow'd into its Ventricles in ſtead of blood, its motion muſt either have been more notably alter'd, or rather have quite ceas'd, theſe liquors being ſo far diſtant from the nature of blood, eſpecially the Broth.

And laſtly, that this motion is not cauſed partly by the influx of the Animal Spirits, and partly by the accenſion and rarefaction of the blood, may be evinced by the Arguments produced againſt each Opinion apart: and yet if a Reaſon could be given, this ſeems the moſt probable. Namely, that the blood diſtilling into the Ventricles of the Heart, is in them accended and rarefied, ſo that requiring a larger ſpace, it bears againſt their Sides: whereby the Heart being moleſted, it calls in the Animal Spirits for help, which coming in in convenient plenty contract its muſcular Fibres, and ſo by ſtraitning its Ventricles drive forth the blood contained in them into the Arteries. But we had rather ingenuouſly confeſs our ignorance of the reaſon of ſo admirable an action, and profeſs with Dr. *Lower*, that it is too hard for Man to conceive of; and that it is the Prerogative of God onely, who *ſearcheth the ſecrets of the Heart*, to know the reaſon of its *motion* alſo.

CHAP. VI.

Of the Pulſe, and the circulation of the Blood.

The Pulſe.

THE *motion* of the Heart is called in Greek σφύξις, in Latin *Pulſus*, pulſe or beating. And this is performed by *Diaſtole*, or Dilatation, in which it receives blood *into* its Ventricles; and *Syſtole*, or Contraction, by which it expels it *out* of them.

Syſtole *and* Diaſtole.

Contraction being the proper motion of a Muſcle, the *Syſtole* is the proper motion of the Heart; and the *Diaſtole* is but a ceaſing or reſtitution from that motion. For in the *Diaſtole* the Fibres of the Heart are relaxed, during which the blood diſtils down into its Ventricles out of the Auricles; whereby when they are filled and in ſome meaſure diſtended, the Fibres both ſtreight and oblique begin to contract themſelves, and compreſs or ſtraiten the Cavities of the Ventricles, not only by conſtringing their ſides, but alſo by drawing up the cone or tip of the Heart nearer its baſis, whereby their Cavity is ſhortned, ſo that the blood is expelled with force out of them into the Arteries; which motion is called the *Syſtole.* But why the Heart ſhould keep ſuch ſtated turns of *Syſtole* and *Diaſtole*, and continue them for (it may be) fourſcore years together, *that* (as we ſaid above) we cannot conceive the reaſon of, but admire the Wiſdom and Power of the Creatour, in beginning and continuing ſuch a motion.

Whether the pulſation of the Arteries depend wholly on that of the Heart.

At the ſame time as the Heart beats, there is a pulſation of all the Arteries to be felt in the extream parts of the Body. Whence may ariſe a diſpute, whether the Arteries be not alſo endued with a pulſifick faculty. I incline to the Negative, and think their pulſation is meerly paſſive, and that as for other reaſons, ſo upon the account of theſe two Experiments, *viz.* 1. That if an Artery be cut in ſunder, and a Pipe be put into each end of the divided Artery, whereby the blood may be conveyed out of one into the other, the pulſation will continue beyond the Pipe, as well as on that ſide next the Heart. And, 2. That in transfuſion of blood out of one

Animal into another, though the blood be received into a Vein, yet that Vein will have a pulſation anſwering to that of the Artery in the other Animal whence the blood iſſueth. So that the pulſation of the Artery ſeems wholly owing to the repeated *impetus* of the blood poured into it out of the Heart in each *Syſtole*.

The circulation of the blood.

Now ſeeing by the continual reciprocation of the Pulſe there is a conſtant expulſion of blood *from* the Heart into the Arteries, and as continual an influx of blood *into* it out of the *Cava*; and ſeeing the *Cava* from whence the ſupply is, is never drawn dry, nor on the other hand, the Arteries that receive the blood continually from the Heart, unduly ſwell'd with it; it neceſſarily follows, that this motion proceeds *circularly*, *viz.* that the blood is continually driven out of the Heart into the Arteries, out of theſe into the parts to be nouriſhed; from whence it is reſorbed by the Capillary Veins, which conduct it back through the larger into the *Cava*, and ſo at length it returns to the Heart again. The invention of which Circulation is owing to our Countryman Dr. *Harvey*, and may be prov'd undeniably by theſe reaſons.

1. The great quantity of blood that is driven out of the Heart into the Arteries at every Pulſe. For though the Ancients who knew not this Circulation, imagin'd that only a drop or two were expelled by every *Syſtole*, which they were neceſſitated to ſuppoſe, to avoid the great diſtenſion that the Arteries muſt be liable to, if any conſiderable quantity iſſued into them; yet it is certain and demonſtrable that there muſt needs an Ounce or more be driven into them each time. For (taking it for granted that there is

no other way for any liquor to paſs from the Stomach to the Kidneys but through the Heart, along with the blood) ſeeing if ſome Men at ſome times drink three Pints of Drink, they ſhall Piſs it out again in half an hour, yea more of *Tunbridge* Waters in that ſpace; and ſeeing ſecondly, that there is commonly as much blood as *Serum* that flows to the Kidneys (the blood returning back by the Emulgent Veins) it is clear that by the two Emulgents (which are none of the largeſt Arteries) there muſt paſs in half an hours time ſix pounds of liquor, all which muſt come from the Heart; and how much more then may we conceive to be driven through all the other Arteries that run through the whole Body? This is more accurately evinced by Dr. *Lower*'s Experiment, which is this: "I cut aſunder (*ſays he*) both the *Cervical* Arteries in "a large Dog, and at the ſame time through an "hole made in the left ſide of his Breaſt over a"gainſt the Heart, I compreſt the Trunk of the "*Aorta* below the Heart with my Finger, to hin"der any blood from deſcending by it; and laſt"ly, I took care alſo to ſtraiten the *Brachial* Ar"teries under the *Axillæ*, by which means al"moſt all the blood was driven out of the Heart "through the *Cervicals* (beſides that which was "ſent into the *Vertebrals*) and which is wonder"ful to be related, within the twentieth part of "an hour the whole maſs iſſued out; ſo that it "is not to be denied but that it all paſt through "the Heart in that ſpace.] And though it may be granted that amidſt ſuch wounds and tortures the Heart does beat ſomewhat quicker than at other times; yet the ſame thing is partly evident from wounds in the Limbs when ſome notable Artery is cut aſunder, for 'tis ſtrange in how ſmall a time a Man will bleed to death even at that one Artery. Yea we may give a great gueſs how much blood is ſent out at every Pulſe, even from the ordinary opening of one *Vein* in the Arm, from whence a notable quantity of blood will iſſue in a ſhort time; how much then may we ſuppoſe would flow out of all the Veins, if they were opened at one time? Seeing then 'tis evident that ſo great a quantity of blood is expelled out of the Heart at every *Syſtole*, and that for all that the Arteries are not unduly diſtended nor any part ſwell'd by it, neither yet the *Cava* and other *Veins* emptied, 'tis certain that the blood that is driven into the Arteries flows back to the Heart by the Veins, in a conſtant circulation.

2. A ſecond Argument to prove it, may be taken from the Valves in the Veins, which are ſo framed that blood may freely flow through them out of the leſſer Veins into the greater, (and ſo into the *Cava*) but not on the contrary out of the greater into the leſs. Yea if one blow into the *Cava* through a Pipe, there will no wind paſs into the ſmaller Veins; but on the contrary, if you blow up the leſſer Veins, the wind will readily paſs to the larger, and ſo to the *Cava.*

3. And laſtly, The ſame thing is moſt clear by the Ligature in Blood-letting. For whether you let blood in the Arm or Foot, you always tye the Fillet above where you intend to make the Orifice, and then the Vein below the Ligature will preſently fill and grow tumid, but above it will fall and almoſt diſappear. Which muſt needs be from hence, for that the blood being driven along the Arteries towards the extreme parts,

returns by the Veins and aſcends upwards, which coming to the Ligature and being ſtopt there, ſwells the Vein below the Ligature, and ſpurts out as ſoon as the Orifice is made: but when the Fillet is looſed again, the blood flows no longer out thereat, but holds on its wonted chanel, the Vein, and the Orifice cloſes up again.

Having ſufficiently demonſtrated the Circulation of the Blood, we will ſhew two things further; *firſt*, how the blood paſſes out of the Arteries into the Veins, and *ſecondly*, in how long a time the whole maſs of blood may be ſuppoſed to paſs through the Heart in its ordinary Circulation.

How the blood paſſes out of the Arteries into the Veins.

As to the *firſt*, it was the Opinion of *Riolanus* that the blood circulated only through the larger Veſſels, by anaſtomoſis or inoſculation of the Veins with the Arteries; and that that which run into the ſmaller, was all ſpent on the nutrition of the parts. But it is clear that there muſt be a circulation even in the ſmalleſt, from the great quantity of blood that will flow out of the leaſt Artery in the Hand or Foot, when it is cut; which it were very abſurd to imagine to be all ſpent on the nouriſhment of the reſpective part. Now there are but two ways whereby the blood can be ſuppoſed to paſs out of the Arteries into the Veins, *viz. either* by the former's being continued to or opening into the latter by inoſculation, *or* elſe by the Capillary Arteries letting out their blood into the pores of the ſubſtance of the parts, on whoſe nutrition part is ſpent, and the remainder imbibed by the gaping mouths of the Capillary Veins. That it is neceſſary to admit of this *latter* way, is evident, becauſe if part of the Arterial blood did not iſſue into the ſubſtance of the parts, they could not be nouriſhed by it; for while it is in the Veſſels it may add warmth indeed to the parts thro' which it flows, but cannot nouriſh them, ſeeing even the Veſſels themſelves are not nouriſhed by that ſtream of blood that glides along their Cavity, but by Capillaries running through their Coats; and if the blood be driven into the ſubſtance of the parts, and that in a greater quantity than ſuffices for their nouriſhment, (as was juſt now ſhewn that it is) what is ſuperfluous muſt needs enter the mouths of the Capillary Veins, from which it goes forward to the larger, and ſo to the Heart: But ſeeing this way of transfuſing the blood through the ſubſtance of the parts has ſeemed to ſome not to anſwer to that haſty circulation of it we above demonſtrated; they have thought it neceſſary alſo to admit of the *former* way, namely anaſtomoſes, by which the Veins are continued to the Arteries, and that not only in their larger branches (as that notable one of the Splenick Artery with the Splenick Vein) but alſo in their ſmaller twigs in the extreme parts. But we muſt conſider, that in a living body the ſolid parts are infinitely more porous and permeable than in a dead; ſo that though the Anatomiſt find their ſubſtance ſo denſe and cloſe, as to make it ſeem almoſt impoſſible they ſhould permit ſo quick a paſſage to the blood through them: yet he ſhould rather believe it, than ſuppoſe ſuch anaſtomoſes as he cannot diſcover, (though it were not difficult to find them out if they had an exiſtence.) For abating that ſingle one of the Splenick Artery with the *Ramus Splenicus* of the *Porta*, (and perhaps ſome of the *Arteria* with the *Vena pulmonaris* in the Lungs) none of the lateſt moſt accurate Anatomiſts have been able to find out any. And as for that mentioned, it ſeems rather to be of an Artery with an Artery, (ſuch as are frequent in ſeveral parts of the body,as are alſo of one Vein with another) than of an Artery with a Vein; for the *Porta* from which this *Ramus* is propagated, is generally reputed rather an Artery than a Vein, for the reaſons alledged in Chap. 12. of Book I. where we deſcribed this Veſſel.

In what ſpace of time the whole maſs circulates.

And *ſecondly*, as to the ſpace of time in which the whole maſs of blood may ordinarily circulate through the Heart, it is probably much ſhorter than many have imagined. For ſuppoſing that the Heart makes two thouſand pulſes an hour, (which is the leaſt number any ſpeak of, and ſome have told twice as many) and that at every pulſe there is expelled an Ounce of blood (which we may well ſuppoſe, ſeeing the Ventricles are wide enough to contain two Ounces, and that it is probable, both that they are filled near full in the *Diaſtole*, and that they are near if not quite emptied by the ſtrong conſtriction of the Heart in the *Syſtole*) ſeeing the whole maſs uſually exceeds not four and twenty pound, it will be circulated ſix or ſeven times over through the Heart in the ſpace of an hour. And by ſo much the oftner, by how much the blood comes ſhort of the ſuppoſed quantity, or the pulſe either naturally, or by a Fever, ſpirituous liquors, or violent motion is rendred more frequent. By which quick motion the blood it ſelf is kept from coagulation and putrefaction, and the parts are cheriſhed with vital heat, which heat of the parts is much according to the ſlowneſs or rapidneſs of the circulation; ſo when we ſit ſtill and the pulſe is ſlow or rare, we grow cold; but when upon running or any violent exerciſe the pulſe becomes more frequent and quick, we become hot.

CHAP. VII.

How Blood is made of Chyle, of its Heat and Colour, and whether the Body be nouriſhed by it.

ACcording to Dr. *Harvey*'s Obſervations, there appears in an *Embryo* a *punctum ſaliens*, or red beating ſpeck, which is Blood, before any the leaſt Lineament of the Heart. So that whatever Inſtrument of Sanguification the Heart may appear to be afterwards, it contributes nothing to the making of the firſt blood; but it ſeems rather to be made for the blood's ſake, to tranſmit it to all the parts of the *Embryo* or *Fœtus*, than the blood to be made by it. But it muſt be confeſt that things proceed in the grown *Fœtus* far otherwiſe than they do in the firſt formation. For the parts of an *Embryo* are nouriſhed and encreaſed before it have a Stomach to concoct any thing, and yet in a perfect *Fœtus* none can deny that the Stomach does concoct and prepare nouriſhment for it: ſo it moves before the Brain is formed ſo perfectly as to be able to elaborate Animal Spirits; and yet after it is perfected, every one knows that the Brain does elaborate ſuch Spirits, as, being ſent into all the parts of the Body by the Nerves, enable them to move. In like manner though there be blood in the *Embryo* before the Heart be formed, yet after it is perfected, nothing will hinder but it may at leaſt contribute ſomething to Sanguification.

We will ſuppoſe then, that as all the other parts are formed by the *Vis plaſtica* or generative faculty of the (firſt) vegetative and (then) animal Soul, ſeated in the *Ovum*, and receive their firſt encreaſe by the aſſimilation of the *colliquamentum*; but as ſoon as they are perfected, and the *Fœtus* excluded, are nouriſhed by the blood: ſo the blood it ſelf being at firſt made in like manner, as ſoon as the Veins, Heart and Arteries are completed ſo as it can circulate by them, may, not improperly, be ſaid to be nouriſhed by the Chyle or nutritious juice, the Heart aſſiſting the aſſimilation of the one into the other. And this is done in this manner. The Chyle aſcending by the *Ductus thoracicus* (as was deſcribed, Book I. Chap. 10.) and flowing into the Subclavian Vein, together with the returning venal blood is poured by the *Vena cava* into the right Auricle, and ſo into the right ventricle of the Heart in its *Diaſtole* or Relaxation; then by its *Syſtole* or Contraction it is driven out from thence into the Lungs, from whence it aſcends again into the left Auricle firſt, and then into the left Ventricle of the Heart, out of which it is expelled through the *Aorta*, and paſſing along with the blood through the Arteries of the whole body, returns again with it by the Veins to the Heart. For it undergoes many circulations before it can be aſſimilated to the blood. Which is evident, both becauſe it is the Chyle (but little alter'd) that is ſeparated in the *Placenta uteri* for the nouriſhment

How chyle is turned into blood.

ment of the *Fœtus*, and in the Breaſts for the Infant to ſuck, in the form of Milk; and alſo from hence, that if one be let blood four or five hours (or later) after a full Meal, there will a great quantity of the milky Chyle it ſelf ſwim a-top the coagulated blood. But every time the new infuſed Chyle paſſes through the Heart with the blood, the particles of the one are more intimately mixed with thoſe of the other in its Ventricles, and the vital Spirit and other active principles of the blood work upon the Chyle; which being full of ſalt, ſulphur and ſpirit, as ſoon as its *Compages* is looſened by its fermentation with the blood in the Ventricles of the Heart (eſpecially, but alſo in the Arteries) the principles having obtained the liberty of motion do readily aſſociate themſelves; and are aſſimilated with ſuch parts of the blood as are of a like and ſuitable nature; ſo that at length all the maſs of Chyle that is capable of being turned into blood, is ſanguified; and what is not, is evacuated by Urine or Stool, or other proper Emunctory.

How the blood becomes hot.

It is a very difficult queſtion, by what means the blood acquires its *heat*. In order to the reſolution whereof it will be neceſſary to conſider how many ways a *liquid body* is capable of being heated; and thoſe (according to Dr. *Willis)* are three. " *Firſt*, by ſetting it to ſomething that is " hot; ſo Water is made hot by being ſet on the " Fire, or in the Sun, or a Stove, or by diſſolving " Lime in it. *Secondly*, when Saline Corroſives, " which are of a contrary nature, being mixt " with one another, or with ſulphureous, act one " on another, and by the great ſtrugling and agi-

“ tation of their particles do often excite heat, “ yea ſometimes ſmoke and burning; as when “ ſpirit and butter of Antimony, or when *aqua* “ *ſtygia* and Oyl of Turpentine are mixed toge- “ ther; alſo when corroſive liquors eat into me- “ tallick bodies, they often grow hot. *Thirdly*, “ (which is the only way beſides that a liquid “ grows hot) when ſome humour abounding with “ ſulphur or much ſpirit is ſet on fire by holding “ a flame to it, and ſo grows hot by deflagration, “ as Brandy, *&c.* There are other ways indeed “ of calefaction, as *fermentation*, *putrefaction*, and “ *attrition*, whereby *thicker* or *ſolid bodies* often “ grow hot, but in *liquid* they produce no ſuch “ effect. Thus Leaven becomes (ſomewhat) hot “ by *fermentation*, and Dung or wet Hay by *pu-* “ *trefaction*; but neither way will a *liquid body* “ wax hot: for though Wine, Cider, *&c.* fer- “ ment ſo much as to burſt the ſides of the Hogs- “ head, yet they are not actually hot; nor will “ blood become ſo, when it is let out of the bo- “ dy, diſpoſe it how you will in fit Glaſſes to fer- “ ment or putrefie. Indeed the blood within the “ body is fermented, and is thereby depurated, “ but it is not heated by ſuch fermentation, as “ neither is any other liquid. Neither does the “ heating by *attrition* agree to it; for though ſo- “ lid bodies are heated by being rubb’d one a- “ gainſt another; yet ſhake and agitate Liquids “ as much as you will, they ſhall be never the “ warmer for it. Therefore ſeeing there are “ only thoſe three ways firſt mentioned whereby “ actual heat can be produced in any Liquors, “ let us ſee to which of them the incaleſcence of “ the blood ought to be aſcribed.

“ *Firſt*, both the Ancients and ſome Moderns are of opinion, that the blood is heated the firſt way, *viz.* by the admotion of ſomething that is hot. Thus the former have taught that the *innate heat*, and the latter that the *vital flame* is lodged in the Heart, and heats the blood as it paſſes through it: But both theſe Opinions fall to the ground, ſince it is clear that the Heart is a *mere muſcle*, and contains no fit fewel for perpetuating a flame, or I know not what implanted heat: For though it muſt be acknowledged that the circulation of the blood depends on the continual motion of this bowel, yet the *Heart* derives its heat wholly from the *blood*, and not the *blood* its from the *Heart*.

“ *Secondly*, this heat cannot be cauſed in the blood the ſecond way, becauſe its liquor in a natural ſtate is always homogeneous; and though it abound with ſalt, yet that is only volatile, mild and benign. Nor can any one diſcover either in the *Heart*, or in any other *focus* a ſaline or otherwiſe heterogeneous mineral, by acting whereupon or corroding whereof the ſanguineous liquor ſhould conceive heat.---

“ *Thirdly*, as to the third way, whereby liquids grow hot, though it ſeem an hard ſaying, that *the blood is accended*; yet ſeeing we can attribute its incaleſcence to no other cauſe, why ſhould we not impute it to this? eſpecially ſeeing the *proper paſſions of fire and flame* agree to the *life of the blood.*

“ For the chief and moſt eſſential Requiſites to continue a flame are theſe three, *firſt*, that a free and continual acceſs of air be granted to it as ſoon as it is kindled; *ſecondly*, that it enjoy a conſtant ſulphureous *pabulum* or fewel;

" and *thirdly*, that it be ventilated, whereby as " well its fuliginous, as thicker recrements may " be continually amanded from it: And ſeeing " theſe agree to the *vital flame* as well as to an " elementary, it ſeems very rational to affirm " that *life it ſelf is a kind of flame.*] Thus far that learned Author, whom the Latin Reader will do well to conſult diſcourſing further on this ſubject, in his *Exercit. medico-phyſica de ſang. incaleſcentia ſive accenſione.*

Dr. *Henſhaw* thinks that " the diſſimilitude of " parts between the Chyle and Blood is ſo great, " that it becomes immediately the cauſe of an extraordinary ebullition upon their mixture together; which is very much encreaſed by the reciprocal motion of the Lungs, whereby the " blood is wrought almoſt into a froth or foam " by that time it gets into the left Ventricle of " the Heart. Which ſudden exceſs of heat, is not " unlike what happens upon the mingling ſeveral " Chymical liquors together, as ſpirit of *Wine* and " ſpirit of *Turpentine*, and other ſuch like, where " the heat becomes ſo great, that it often endangers the Veſſels they are contained in. He affirms (contrary to Dr. *Willis*, and I think to the truth) that " new Wine or Muſt while it " ferments, is hot; and that if juice newly preſſed out of the Grapes were added to it as it " begins to cool, it would again renew its ebullition, and its warmth would be continued ſo " long as one ſhould perſiſt to do ſo: In like " manner he thinks is the warmth in the blood " continued by the new affuſion of Chyle, which " renews its fermentation, and conſequently invigorates its heat.

Diemerbroeck is of opinion, that "the *vital ſpi-* "*rit* (by which he underſtands the more ſubtile "part of the blood) while through its great "volatility it always endeavours to flie away, "does continually agitate the other thicker par- "ticles of the blood, with which it is intangled "and detained from flight, and is diverſly vibra- "ted by them, and beat back; and ſo the whole "maſs being kept in a continual fermentative "motion, there is produced in it an heat, which "in a great agitation is great, in a mean, mean, "and in a ſmall, ſmall.

I might cite other Opinions concerning the reaſon of this *heat*, but they generally fall in with ſome of theſe mentioned: of which I ſhall not make my ſelf an Umpire, but think that Dr. *Willis* has ſaid enough in his above-cited Exercitation, to evince that it is not cauſed either of theſe latter ways, *viz.* by fermentation, or by agitation of the particles of the blood in the manner *Diemerbroeck* deſcribes it; and whether the accenſion of the blood be a more probable reaſon of it, let the Reader judge.

The colour of the blood.

Why the Blood ſhould be of a *red colour* rather than any other, no ſatisfactory reaſon (I think) can be given but the Will of the Creatour, though ſome attribute it to the Heart, others to the mixture of ſalt and ſubacid juices with ſulphureous, becauſe from ſuch a mixture there reſults a red colour, as appears in the diſtillation of Sal nitre, (which contains many ſulphureous particles in it;) or by the pouring Oil of Vitriol upon Conſerve of Roſes, or other thing that is of a *paliſh* red, (if it contain any thing of ſulphur) for it will be thereby made of a moſt *deep* red. We will not ſpend time to ſhew in how many reſpects theſe Inſtances differ from the *Phænomenon* under conſideration, but ſhall content our ſelves with inquiring from whence the difference of colour ariſes between the Venal and Arterial Blood. Every one knows that when blood is let out of a Vein into a Porringer, the *coagulum* is of a florid ſcarlet colour in its ſurface, but of a dark red from the ſuperficies to the bottom, and of ſuch a colour it appears as it ſtreams out of the Orifice of the Vein. But if an Artery be cut, the ſtream then looks of a far brighter colour, like the ſuperficies of the Venal blood when it is coagulated in a Porringer. Now the Arterial blood receives not this florid colour in the Heart, but in the Lungs. For if it receiv'd it in the Heart, then might the right Ventricle be ſuppoſed to give it as well as the left: but that it does not do ſo, is clear by this Experiment of Dr. *Lower*'s. If you open the *Vena arterioſa* which receives the blood out of the right Ventricle, the blood differs nothing in colour from the Venal, but its curdled part looks every whit as black. But if one open the *Arteria venoſa* as it is entring into the left Ventricle, it has the perfect colour of Arterial blood; which ſhews, that as it ows not that colour to the left Ventricle any more than to the right, (being not yet arriv'd at it) ſo it muſt receive that alteration of colour in the Lungs, in which the nitrous air being diffuſed through all the particles of the blood is intimately mixed with it, and (if you will) accends it. For if there be any ſuch thing as a *Flamma vitalis* (properly ſo called) in Animals, though the Blood (or Chyle rather) be to it in ſtead of the Oil or other matter whereon it feeds, yet it oweth the continuance of its burning to the Air, without the continued inſpiration of which the Animal cannot live, but inſtantly dies, even as a Candle is preſently extinguiſhed if you put it in a cloſe place where the air cannot come to it, or by ſome Engine be ſuckt from it. But this by the bye. For I muſt confeſs that (how plauſible ſoever this Opinion may ſeem on other accounts) this alteration of the colour of the Blood by the Air in the Lungs, is no ſufficient Argument to prove any ſuch vital flame, ſeeing the Arterial blood being extravaſated, retains it florid colour, when no doubt if there ever was any accenſion, the flame is extinguiſhed. But this ſcarlet colour is owing meerly to the mixture of the particles of the Air with the Blood in the Lungs, from which it tranſpires, in a great meaſure, through the pores of the Skin, while the blood circulates in the habit of the Body out of the Arteries into the Veins, whence the Venous blood becomes ſo much darker in colour than the Arterial. And yet the Venous blood it ſelf when extravaſated appears of a ſcarlet dye in its ſurface, which is meerly from its being expoſed to the Air; for if one turn the congealed blood in a Porringer upſide down, the bottom which at the turning is blackiſh, will in a little while turn to a lighter red.

Whether the Body be nouriſh'd by Blood.

Though we have confeſſed that the Chyle does circulate through the Body ſeveral times before it be perfectly aſſimilated to the blood; yet we do not think that it paſſes into the nouriſhment of the parts in the form of Chyle. And therefore when ſpeaking of the Nutrition of the *Fœtus* in the Womb (Book I. Chap. 33.) we often mentioned a *nutritious juice* (which was Chyle a little alter'd) we did not call it ſo with reſpect to the ſolid parts of the *Fœtus*, but to the blood it ſelf whoſe *Pabulum* or nouriſhment it is, as ſoon as the Umbilical Vein is formed, as the blood is of the Body. For as to the encreaſe of the firſt delineated parts of an imperfect *Embryo*, that is far different from ordinary nutrition.

The Blood then conſiſting of particles of a different nature, each particle paſſes into the nouriſhment of that part which is of the ſame nature with it. So the ſalt and ſulphureous particles being equally mixt, are agglutinated and aſſimilated to the fleſhy or muſculous parts; the oily and ſulphureous to the Fat; the ſalt and tartareous to the Bones, *&c.* Now this is not done by any election or attraction of the parts, as if they pick'd and choos'd (with a kind of diſcretion) ſuch particles of the blood as are ſuitable to their own nature; for the maſs of blood is equally and indifferently carried to all the parts: But there is that diverſity of figure both in the ſeveral particles of the blood and in the pores of each part, that in the circulation through the habit of the Body ſome ſtick in theſe, and others in thoſe, where they are faſten'd and united to the ſubſtance of the reſpective parts; and thoſe which through their peculiar figure are unapt to adhere to one or other, return again to the Veins and ſo to the Heart, where they receive ſome new alteration. So that as *the life of the Fleſh is in the Blood* (according to *Levit.*17.11.) ſo has it its vital heat and nouriſhment from it alſo.

CHAP. VIII.

Of the parts of the Heart, viz. *the* Auriculæ, *the Ventricles, and the* Septum *that divideth them.*

HAving treated of the *Heart* in general, and of its *Action, &c.* we now come to diſcourſe of the *Parts* which it conſiſts of, *viz.* its two *Auriculæ*, two Ventricles and the *Septum.*

The *Auriculæ* or *Ears* of the Heart are ſo called from ſome ſimilitude of ſhape they have with thoſe of the Head, for they riſe from a long baſis, upon the baſis of the Heart, and end in an obtuſe point, making an obtuſe triangle. They are as it were two Appendages of the Heart, ſeated at its baſis over the Ventricles. They are of the ſame fabrick and uſe, being both Muſcles, and made up of the ſame order of Fibres, which are carried into oppoſite Tendons, whereof that at the baſis of the Heart is common to it and theſe *Auriculæ*, and the other runs along their upper part. The right is larger and ſofter, the left is leſs, but more firm. Their ſuperficies is ſmooth when they are filled; but when empty, it is wrinkled, and the left more than the right. When they are cut open, there appear in their Cavity many fleſhy columns running from the upper to the lower Tendon, and betwixt them there are pretty deep Ditches or long Cavities, but fewer in the right than the left. Auriculæ.

They are dilated and contracted in like manner as the Heart, but at different times: for the *Syſtole* of the Ventricles is at the ſame time with the *Their Motion.*

the *Diaſtole* of the *Auriculæ*; and on the contrary, the *Syſtole* of the *Auriculæ* with the *Diaſtole* of the Ventricles. So that the *Auriculæ* are a receiving their blood from the Veins, while the Ventricles are expelling theirs into the Arteries; and when the Ventricles are relaxed and empty in their *Diaſtole*, the Auricles force their blood into them by their *Syſtole*.

Uſe. They ſerve to receive the Venal blood immediately out of the *Vena cava*, and *Pulmonaris*, and to meaſure it, as it were, into the Ventricles. Whither that they may expel it with the greater force, the internal Fibres or Columns of their Cavity ariſing from their root where they are joyned to the baſis of the Heart, reach directly outwards towards the *Vena cava*, and *Pulmonaris*, and in the *Syſtole* of the *Auriculæ* graſp the blood contained in their cavity like ſo many fingers, and ſqueeze it into the Ventricles whilſt they are relaxed in their *Diaſtole*.

The Ventricles. The Heart hath two Cavities, called *Ventricles*, whereinto it receives the blood from its two Auricles, and out of which it expels it into the *Arteria pulmonaris* and *Aorta*. They are not altogether like one another; for the right is wider, and in ſhape almoſt ſemicircular, nor reacheth it down to the *Mucro* or tip of the Heart; whereas the left is almoſt round, and reacheth down to the very tip. Now though the outſide of the Heart be ſmooth, yet theſe Ventricles are very unequal, having their ſides hollowed into divers Interſtices or Furrows, and interwoven with carnous Fibres reaching this way and that way. They are more numerous in Men's Hearts, than in thoſe of any other Animal; though ſuch as are big, as Horſes and the like, have them larger. Theſe Fibres or fleſhy Columns ſerve to ſtraiten or conſtringe the Ventricles, and the clefts or furrows betwixt them help their ſides to cloſe more exactly in their *Syſtole* than they could have done, had they been ſmooth. The Fibres are more and ſtronger, and the furrows deeper in the left Ventricle than in the right, yea they are alſo in that ſide of the *Septum* that makes part of the left, though that ſide that looks to the right be well-nigh ſmooth. For there was need of greater and ſtronger conſtriction in the left than in the right; ſeeing the right expels the blood to no greater circuit than through the Lungs, but the left to the extremeſt parts of the Body.

Septum. They are divided from one another by the *Septum*, which is a carnous and denſe partition that ſtands like a Wall betwixt them. It is hollow towards the left Ventricle, and (as was juſt now ſaid) has ſuch like Fibres and Clefts as the reſt of the Cavity; but towards the right it is convex or bunching out, and has but very little inequality. Many have been of Opinion that it has ſome wider pores through which part of the blood does paſs immediately out of the right into the left Ventricle; but he that ſearches for them diligently will find none, unleſs he firſt make them with his Probe. And indeed if there were any in grown perſons, we may much more ſuppoſe them to be in *Fœtus*'s in the Womb, in whom are ſeveral paſſages that after the birth are obliterated. But if theſe were in the *Fœtus*, then ſhould Nature have made thoſe two other paſſages in vain, namely the *Foramen ovale*, whereby the blood paſſes out of the *Cava* into the *Vena* *pulmonaris* as it is entring the left Ventricle; and the *Canalis arterioſus*, which carries the blood out of the *Arteria pulmonaris* into the *Aorta*. I ſay, if the blood could have paſſed out of one Ventricle into the other (without going through the Lungs) by any pores that perforate the *Septum*, theſe other paſſages had been ſuperfluous. And therefore we may ſuppoſe, that as in grown perſons they cannot be found by any Probe or Briſtle, ſo they were not there even while the *Fœtus* was in the Womb, ſeeing there was no occaſion for them.

As to the *uſe* of the Ventricles, it may be learned partly by what has been diſcourſed in the three former Chapters, and partly by what ſhall be ſaid further in the following, wherein we are to deſcribe the Veſſels opening into and out of them. Whither alſo we transfer the treating of their *Valves* that are placed at their Orifices.

CHAP. IX.

Of the aſcending Trunk of Vena Cava.

BEcauſe the Veſſels contained in the *Thorax* either open into the Heart or run out of it, having finiſhed the deſcription of *It*, we ſhall diſcourſe next of *them* as appendages to it. But waving the repetition of what we diſcourſed Book I. Chap. 10. of the *Ductus chyliferus thoracicus*, that runs up the *Thorax* by the Spine, and opens into the Subclavian vein, and referring the Reader thither for the deſcription of that veſſel; I ſhall

I ſhall here only meddle with the Sanguiferous veſſels that are four in number, *viz. Vena cava*, *Vena arterioſa* (or *Arteria pulmonaris*) *Arteria venoſa* (or *Vena pulmonaris*) and the *Aorta* or *Arteria magna*; and in this Chapter of the firſt, *viz. Vena cava.*

Venacava. In the former Book, Chap. 12, and 13. where we diſcourſed of the Veſſels contained in the *Abdomen*, we ſuppoſed (with the *Galeniſts*) that both the *Vena portæ* and *Cava* had their riſe from the Liver, not dogmatically aſſerting it, but ſuppoſing it for methods ſake. And in Chap. 13. deſcribing the branches of the *Cava* in the *Abdomen*, we found it preſently dividing it ſelf (after its riſe out of the upper part of the Liver) into the *Aſcending* and *Deſcending* Trunk; the deſcription of the branches of the *latter* (in the lower Belly) we there finiſhed; but traced the *Aſcending* Trunk no further than its penetrating through the Midriff up into the *Thorax*, deferring the further proſecution of it till this place that we come to treat of the Veſſels contained in the *Thorax*.

Venæ phrenicæ. As it aſcends through the Midriff it ſends forth a ſmall ſprig on each ſide, called *Venæ Phrenicæ*; theſe run through the Midriff, the *Mediaſtinum* and *Pericardium*. If at any time matter gathered in the cavity of the *Thorax* be afterwards diſcharged by Urine, (which many Phyſicians have affirmed) it is probable that it is abſorbed by the mouths of theſe Veins gaping in the upper ſide of the Diaphragm, (upon which ſuch matter muſt be ſuppoſed to fluctuate) whereby it is brought into the *Cava*, and ſo in the circulation is ſeparated by the Kidneys out of the Emulgent Arteries, and deſcends by the Ureters to the Bladder.

From

Venæ coronariæ. From the Diaphragm it paſſes undivided to the right Auricle of the Heart, but before it enter it, having pierced the *Pericardium* it ſends forth ſometimes one, ſometimes two twigs called *Venæ coronariæ*, which compaſſing the *baſis* of the Heart bring back into the *Cava* the blood that is ſuperfluous from its nutrition. As theſe open into the *Cava*, there is a *Valve* placed, which permits the blood to return by them into the *Cava*, but hinders any to paſs out of the *Cava* into *them*.

Before this Trunk of *Vena cava* open into the Auricle, it is joyned to that other Trunk that deſcends from the *Claviculæ*, (though for method's ſake we muſt conſider *that* as a continuation of *this*, by and by) and both of them diſcharge the blood contained in them by one mouth firſt into the Auricle and then into the Ventricle of the Heart. As they are going to joyn, there comes a Tubercle or Protuberance betwixt them, that hinders the one from opening into the other in a direct line, but makes them both go obliquely towards the left hand as they enter the *Auricula*; without which proviſion, that blood that is a deſcending from the *Claviculæ* would have faln ſo full on that which is aſcending by this Trunk of the *Cava*, we have been a deſcribing, as muſt have made it either to ſtagnate (if not regurgitate) or however would have retarded its motion.

Now immediately beyond this Protuberance, out of the united Trunk there goeth a paſſage (called *Foramen ovale*) along the *baſis* of the Heart to the *Vena pulmonaria* in *Fœtus*'s in the Womb, which as ſoon as they are born cloſes up and is obliterated. The reaſon of this paſſage of the blood in them is, becauſe their Lungs having either none or but a very obſcure and imperfect motion, the blood does but little of it paſs through them, but a good part of it through this *Foramen* out of the *Cava* into the *Vena pulmonaria* juſt as it is entring into the left Auricle, through which this blood is diſcharged into the left Ventricle together with that little that is returning by the ſaid *Vena pulmonaria* from the nutrition of the Lungs. For though there be expelled out of the right Ventricle a pretty quantity of blood at every pulſe into the *Arteria pulmonaris*, yet there is but a little of it that goes to the Lungs, (though all do in adult perſons, that it may be there impregnated with air) but the greateſt part by a Pipe ariſing from this Artery, called *Canalis arterioſus* runs into the *Aorta*, which Pipe does degenerate into a Ligament after the *Fœtus* is born. So that the *Fœtus* in the Womb liveth after the manner of Fiſh or other Creatures that have no Lungs, and but one Ventricle of the Heart; for there is but very little of its Bloud that paſſeth any more than one of its Ventricles in one circulation, that which circulateth through one miſſing the other. But to return:

The united trunk of the *Cava* opens by one large Orifice into the right ventricle of the Heart, (as moſt Anatomiſts have taught; but *Steno* affirms, it goes no further than the Auricle) into which is poured all the Bloud that returns from all the parts of the Body (except the Lungs) in its circulation. And leſt in the *Syſtole* or conſtriction of the Heart, the Bloud ſhould be expelled the ſame way it comes in; at the Orifice of the *Cava* there grows a membranous circle, which is cleft into three membranous *Valves*, looking

inwards,

Valvulæ tricuſpides. inwards, called *Tricuſpides* (or three-pointed) which permit the Blood to come in, but not to go out. And this office theſe Valves perform in this manner, (as is moſt ingeniouſly deſcribed by Dr. *Lower.*) Out of the ſides of the right *Ventricle* there grow certain *Papillæ*, or round and long Caruncles (called before, fleſhy Columns) from whoſe top there proceed certain tendinous Fibres that are knit to theſe Membranous *Valves.* Now theſe Membranes encompaſs the orifice of the *Cava* round about, ſo that whereas the *Mucro* or tip of the Heart is in every *Syſtole* drawn up towards the *baſis*, the *Papillæ* being alſo moved upwards, do ſlacken their Fibres (like Bridle-reins) whereby it comes to paſs that the Membranes (or *Valves*) alſo, to which they are tied, hanging looſe are driven upwards (like ſails filled with wind) by the Blood that is ſqueezed in every *Syſtole* of the Heart, and thereby they ſhut this inlet into the Heart ſo cloſely, that not a drop of liquor can flow back again into the *Auricula* or *Cava*, but is expelled all into the *Arteria pulmonaris*, whoſe orifice is now open: But, as in every *Syſtole* of the Heart (its tip being brought nearer its *baſis*) the *Papillæ* do much relax their Fibres; ſo in the *Diaſtole* the tip receding from the *baſis* again, does alſo draw down the *Papillæ*, and their Fibres with it: whence it comes to paſs that the *Membranes* or *Valves* being alſo drawn down, do preſently uncloſe this Orifice, and open the door as it were for more Blood to come in, what came in before being expelled in the laſt *Syſtole.*

The two Trunks of the *Cava* having thus diſcharged themſelves by one orifice into the right ventricle, that Trunk which aſcends towards the *Claviculæ* (for ſo we muſt conſider it for orders ſake, though in truth it deſcends from thence) aſſoon as it is gone out of the *Pericardium*, ſendeth forth a notable branch called *Vena ſine pari*,(or *ἄζυγος*) becauſe it is but one, having no fellow.

Vena ſine pari.

It ariſeth out of the hinder part of the *Cava*, but more towards the right hand, and deſcends through the right ſide of the cavity of the *Thorax*. After its riſe, which is betwixt the fourth and fifth *vertebra* of the Breaſt, it bends a little forward toward the right hand, till it be deſcended as far as the eighth or ninth *vertebra*, where it begins juſt to keep the middle. It ſends forth on each ſide Intercoſtal branches to the Interſtices of the eight loweſt Ribs; and at the eighth Rib it is divided into two branches: One whereof, being the larger, deſcends toward the *left hand* betwixt the proceſſes of the Diaphragm, and is inſerted ſometimes into the *Cava* above or below the Emulgent, but oftener into the Emulgent it ſelf: The other being the *right* is joined alſo to the *Cava*, commonly a little above the Emulgent, but ſeldom into the Emulgent it ſelf.

How Pus *collected in the* Thorax *is voided by urine.*

It was formerly held, before the circulation of the Blood was found out, that in an *Empyema* of the *Thorax*, the matter was abſorbed by the mouths of this Vein, and carried directly to the Emulgent Veins, where it was ſeparated with the *Serum* by the Kidneys. But ſeeing the Blood does indeed aſcend from the Emulgents by this Vein, and that at its inſertion into them there is commonly a Valve that hinders any thing from iſſuing out of the *Vena ſine pari* into the Emulgent, but permits the contrary; it is certain, that if this Vein be at any time an inſtrument to evacuate ſuch *Pus*, it muſt firſt aſcend to the *Cava*, and paſs through the Heart, and ſo be carried to the Kidneys by the *Aorta* and the Emulgent arteries ariſing out of it. But though it is difficult to conceive how the mouths of this Vein ſhould open ſo wide into the cavity of the *Thorax*, as to imbibe ſlimy ropy *Pus*, and yet not let forth the Blood that is more fluid; ſo that one would hardly aſſign this office to it: yet when the *Pus* is collected betwixt the *Pleura* and Intercoſtal Muſcles, and the Tumour does not burſt, I ſee not why it may not be ſuppoſed that the Intercoſtal branches of the *Vena ſine pari* do imbibe the matter out of the Tumour, and carry it that way which was juſt now ſpoken of. And if ever *Pus* be imbibed out of the cavity of the *Thorax*, becauſe it floats upon the Diaphragm, the *Venæ phrenicæ* are liker to do it than this, as was noted before in this Chapter, when we deſcribed thoſe Veins. But the truth is, 'tis more probable, when ſuch matter is voided by urine, that it is abſorbed by neither of theſe veſſels, nor from the places mentioned, but rather by the *Vena pulmonaria* out of the Lungs when they apoſtemate.

Of this *Vena ſine pari* we ſhall ſay no more, but that at its riſe out of the *Cava* it has a *Valve* that opens towards the *Cava*, which having ſent forth this vein, aſcends on towards the *Claviculæ*, ſtrengthned and ſuſtained by the *Mediaſtinum* and *Thymus*, and before it is divided into the two *Rami ſubclavii* (ſometimes after) ſends out yet two other ſmall veins called

Intercoſtales ſuperiores.

The *ſuperiour Intercoſtals*, on each ſide one, each of which has a *Valve* where it joins to the *Cava*, permitting the influx of the Blood into the *Cava*, but hindring its relapſe. Theſe run along the Interſtices or Intervals of the three or four uppermoſt Ribs. Yet ſometimes the *Vena ſine pari* ſends twigs to theſe four Interſtices of the Ribs as well as to the eight lower, and then theſe ſuperiour Intercoſtals are wanting.

Venæ ſubclaviæ.

Afterwards the trunk of the *Cava* is divided into two large Veins, one of which goes to the right hand, the other to the left. Theſe, while they are within the Breaſt, are called *Venæ ſubclaviæ*, running along the under ſide of the *Claviculæ*; but as ſoon as they are gone out of it, *Axillares*. They ſend forth ſeveral branches both *upwards* and *downwards*. Sometimes the ſuperiour Intercoſtals juſt now mentioned (though ſeldom) ariſe out of them. Next, the

Branches ariſing from them.
1. Mammariæ.

Mammariæ deſcend from them; (though theſe ſometimes ſpring out of the trunk of the *Cava*; ſo uncertain is the origine of ſome of theſe Veins.) Theſe ſend forth double branches, Internal and External. The *Internal* run to the griſtly ends of the Ribs and their Intercoſtal ſpaces, and ſome of their twigs alſo are terminated in the glands of the *Mammæ*. The *External* paſs down on the outſide of the Breaſt, and ſend many twigs into the ſaid glands, and marching further by the ſides of the *Cartilago enſiformis* deſcend out of the *Thorax*, continuing their courſe down the *Abdomen*, under the ſtreight Muſcles thereof, till about the Navel, where it hath been an old Tradition that they inoſculate with the *Venæ epigaſtricæ*; but this was a miſtake, as has been noted more than once already. *Bartholin* ſays that ſometimes there is but one *Mammaria*.

2. Mediaſtina.

The ſecond Vein that ariſeth out of the Subclavian is the *Mediaſtina*; this ſends twigs to the *Mediaſtinum* (from which it hath its name) to the *Pericardium* and to the Gland called *Thymus*. This alſo ſometimes ſpringeth out of the trunk of the *Cava*.

3. Cervicalis. The third is *Cervicalis* or *Vertebralis*; this turns backwards towards the *vertebræ* of the Neck, into whoſe lateral holes it enters by ſome ſmall twigs, which diſperſe themſelves through the Membrane that inveſts the marrow contained in theſe *vertebræ*; and other twigs it beſtows upon the Muſcles that lie next upon the *vertebræ*.

4. Muſcula inferior. The fourth is *Muſcula inferior*; this is ſpent upon the lower Muſcles of the Neck and the upper of the *Thorax*. It riſeth ſometimes from the external Jugular.

All theſe ſpring from the lower ſide of the Subclavian veins; but theſe that follow from the upper. As

5. Muſcula ſuperior. The *Muſcula ſuperior*, which is diſperſed thro' the Muſcles of the Neck.

6. Jugulares. Then the *Jugulars*, which are double, *External* and *Internal*. As theſe go out of the Subclavians, there is placed ſometimes one thin Valve, ſometimes two, to hinder the return of the Blood out of the Subclavians into them.

The *External* aſcend on the outſide of the Neck, and theſe are they which are opened when one is let blood in the Neck for any Diſtemper of the Head, or Quinzy, &c. They aſcend but juſt under the Skin, and provide for the outward parts of the Neck, Chaps, Head and Face. They make the Temple-veins, and the Forehead-vein, both which are wont ſometimes to be opened. Yea they ſend ſmall Capillaries through the ſutures of the Skull into the Membranes that cover the Brain.

The *Internal*, in Men, are larger than the *External*. They aſcend from the Subclavian by the ſides of the Wind-pipe, on which they beſtow ſmall twigs. As ſoon as they are come to the *baſis*

ſis of the Skull, they are each divided into two, the greater and leſs. The greater is carried backwards, and by that hole of the *Os occipitis* by which the ſixth pair of Nerves (Dr. *Willis*'s eighth) comes out of the Head, they enter in, and are diſperſed through the *Dura Mater*, &c. The leſs enters in by the holes made for the third and fourth pair of Nerves, and is alſo beſtowed on the *Dura Mater*, &c.

When the Subclavian Veins have ſent forth all theſe branches, they then paſs out of the *Thorax*, and begin to be called *Axillar*, of which we ſhall treat in the Fourth Book, Chap. 1.

Into the *Vena ſubclavia* are inſerted alſo the *Ductus chyliferus thoracicus* (of which in the Firſt Book, Chap. 10.) and *Lymphaticus ramus*, which returns the *Lympha* from the Arms, Neck, *&c.* but ſometimes this opens into the Jugular.

CHAP. X.

Of Vena arterioſa, *and* Arteria venoſa.

THE ſecond veſſel in the Breaſt is commonly called *Vena arterioſa*, but more properly *Arteria pulmonaris*, both becauſe it performeth the office of an Artery, in carrying Blood out of the right Ventricle of the Heart to the Lungs; and alſo becauſe its Coat is double like that of other Arteries.

Vena arterioſa.

As it riſeth out of the right Ventricle of the Heart, there ſtand at its orifice three Membranous *Valves* looking outwards, called *Semilunares*, becauſe they make as it were a half circle,

Its Valves.

as alſo *Sigmoides* or *Sigmoideæ*, from the ſhape of the Greek letter *Sigma*, which of old was of the ſame figure with an Engliſh *C*. Theſe Valves are made of the tendons of the Fibres of the Heart, as *Steno* affirms; yea the ſame tendons, he ſays, paſs into the ſubſtance of the Artery it ſelf. In the *Syſtole* of the Heart they open, and permit the Blood to iſſue out of the Ventricle into this Artery; but in the *Diaſtole* they ſhut, ſo that none can return back again. A little beyond theſe valves in a *Fœtus* in the womb there ſprings out of this Artery a pipe called *canalis Arterioſus*, that runs acroſs the breaſt to the *Aorta*, into which it conveys the greateſt part of the blood out of this Artery, without its paſſing through the left Lobe of the Lungs, or the left Ventricle of the Heart; but aſſoon as the Child is born it cloſes up, and turns ligamentous, as was ſaid before of the *foramen ovale*.

Branckings in the Lungs.

Aſſoon as it is paſt out of the *Pericardium*, it bends towards the *Aſpera Arteria* or Wind-pipe, and is divided into the right and left branch, which applying themſelves to the like branches of the *Aſpera Arteria* do every where accompany them on the under ſide, and as they run along ſend out very many twigs on every ſide, which preſently aſſociate with thoſe of the Wind-pipe, and of the *Vena pulmonaris*. And where the ſmall Pipes of the *Aſpera Arteria* end into the little round Cells (which we ſhall deſcribe in the Chapter of the Lungs) the twigs of this Artery being interwoven with thoſe of the Vein do embrace them like a Net. Whence one may gueſs that the reaſon why the ſanguiferous veſſels do ſo exactly accompany all the branches of the Wind-pipe and its annexed little Bladders, is, that the whole maſs of Blood paſſing this way may be inſpired or impregnated with the particles of the nitrous Air. For there is but a very little ſpent on the nutrition of the Lungs, but the greateſt part of it is received by the ſmall twigs of the *Vena pulmonaria* which accompany thoſe of this Artery in all its ramifications.

Arteria venoſa.

The third veſſel is called *Arteria venoſa*, otherwiſe *Vena pulmonaria*; this has but a ſingle Coat as the other Veins have. After it has accompanied the Wind-pipe and *Arteria pulmonaris* in all their branchings in the Lungs, and by its ſmall twigs has received the Blood (by *anaſtomoſes* as moſt affirm) out of the Artery, all theſe twigs are united firſt into two trunks (*viz.* the right and left) afterwards into one, which opens into the left Ventricle of the Heart.

Its Valves.

At its orifice there are placed two membranous *Valves* called *Mitrales*, becauſe when they are joined together they do in ſome manner reſemble a Biſhop's Mitre. They are of a ſtronger conexture than thoſe called *Tricuſpides* at the orifice of the *Cava* in the right Ventricle; and ſo are the Fibres, that aſcend to them from the *Papillæ* or fleſhy columns, ſtronger. For ſeeing the Blood is expelled more impetuouſly out of the left Ventricle than out of the right, (for the Bloud ſent out of the one is to circulate onely through the Lungs, but that out of the other, through the whole Body) it was convenient that the Valves and Fibres ſhould be ſtronger, to ſuſtain the violent motion of the Blood, and hindring it from returning into this *Vein* again, to direct its courſe into the *Aorta* whoſe orifice opens in the *Syſtole* of the *Ventricle*.

Juſt as this *Vena pulmonaria* is entring into the left Auricle, there is, in a *Fœtus* in the Womb, a Pipe called *Foramen ovale* that opens into it coming from the *Cava*, as was noted above. To which we ſhall here add, that at its orifice into this *Vein* there is a valve placed, that hinders any Blood from returning into the *Foramen* out of the *Vein*.

And here there is one thing worth noting concerning the pulmonary *Artery* and *Vein*, That whereas in all the other Arteries and Veins through the whole Body beſides, the Blood contained in the Arteries is of a bright ſcarlet colour, and that in the Veins of a black purple; on the contrary, the *Arteria pulmonaris* containeth black purple Blood, and the Vein ſcarlet-coloured. The reaſon whereof was ſhewn before, Chap. 7. *viz.* That the ſcarlet colour of the Blood is wholly owing to the mixture of Air with it in the Lungs. And therefore that Blood which the pulmonary Artery brings into the Lungs out of the right ventricle of the Heart, being the Venal blood that was brought thither from the circulation by the *Cava*, changes not its colour till it paſſes out of the ſmall twigs of the ſaid Artery into thoſe of the pulmonary *Vein*, where the airy Particles inſinuate themſelves into it, and ſo alter its colour.

The pulmonary *Vein* hath no Valve in it, except that at its opening into the left Ventricle. Of which Dr. *Willis* gives this reaſon, That the Blood within the *Præcordia* may always, becauſe of the *Impetus* of the paſſions, freely fluctuate and regurgitate both ways, backwards and forwards. And leſt the left ventricle of the Heart ſhould at any time be ſuffocated by the Blood ruſhing too impetuouſly into it, the fleſhy Fibres in the root of the Vein (for both this and the *Cava* have ſuch there, which ſeem to make a kind of Sphincter) by the inſtinct of Nature contracting themſelves invert its courſe, and make it flow backward toward the Lungs.

CHAP. XI.

Of the Aorta, *or great Artery.*

THE fourth veſſel is the great Artery called *Aorta* (*arcula*, a little Cheſt) and by way of eminency *Arteria magna*, becauſe it is the greateſt Artery of the whole Body, from which all the others (except the pulmonary) are derived. Aorta.

It ſpringeth out of the left ventricle of the Heart, and at its riſe hath three *Valves* looking outwards, called *Semilunares*, being altogether like thoſe at the orifice of the *Arteria pulmonaris* in the right ventricle. And theſe with the *Aorta*, according to *Steno*, are both of them conſtituted of the tendons of the Fibres of the Heart, as well as the *Sigmoideæ* and *Arteria pulmonaris*, of which in the former Chapter. Theſe hinder the Blood from returning out of the great Artery into the Heart again. The orifice of the *Aorta* (or rather the Tendon of the Heart that is continuous to it) in ſome Creatures (eſpecially in Harts) does often grow bony; and ſometimes in Men, according to the obſervations of *Bartholin* and *Riolanus*. *Its Valves.*

Aſſoon as the *Aorta* is gone out of the Heart, it aſcends not in a direct courſe towards the Head;

for

for if it had, ſeeing it openeth ſtreight upward out of the ventricle, it would have poured the Blood (eſpecially in lying along) in too rapid a ſtream into the Brain, and the lower parts of the Body would have been defrauded of their due ſhare: but it firſt bends arch-wiſe, ſo that its bowed corner ſuſtains the firſt *Impetus* of the expelled Blood, and directs the greateſt torrent towards its deſcending trunk, and a leſſer quantity paſſes up by the aſcending, being to convey the Arterial Blood to fewer and ſmaller parts.

In a *Fœtus* in the Womb there comes a Pipe out of the *Arteria pulmonaris* into the *Aorta*, called *Canalis arterioſus*, which brings out of it the greateſt part of the Blood that was expelled out of the right *Ventricle*; little more paſſing into the Lungs than may ſerve for their nouriſhment; of which we have given the reaſon in the two former Chapters, as alſo in Book I. Chap. 34. After the *Fœtus* is born, the *Canalis* degenerates into an impervious Ligament, as was alſo noted before.

Before the *Aorta* come out of the *Pericardium*, it ſendeth forth ſometimes one, but oftener two ſmall Arteries, from each ſide one, which compaſs the *baſis* of the Heart like a Garland, in their circuit ſending down divers twigs length-ways of the Heart: they are called *Coronariæ*. When theſe two ſmall Arteries have incompaſs'd the *baſis* and meet, they inoſculate with one another, but not with the *Veins*. At their riſe out of the *Aorta* there is a *Valve* placed, that permits the Blood to flow out of the great Artery into them, but hinders its reflux.

The diviſion of the Aorta *into the aſcending and deſcending Trunk.*

When it hath pierced the *Pericardium*, and bended a little arch-wiſe backwards, it is divided into two Trunks, whereof the one is called *Truncus aſcendens*, the aſcending Trunk; the other *deſcendens*, the deſcending.

Of theſe two, the *deſcending* is largeſt, becauſe it miniſtreth to more parts.

The branches of the Trunk aſcending.

1. Subclavia.

The *aſcending* Trunk running up under the *Vena cava* lies upon the Wind-pipe, and preſently ſendeth forth two large branches, whereof one paſſeth to the right, the other towards the left Arm: They are called *Rami ſubclavii*, becauſe they march under the *Claviculæ*; and aſſoon as they are gone out of the Breaſt, are called *Axillares*. The right is the larger, and riſing higher goes a more direct way towards the right Arm; the left is leſs, and riſing lower aſcends more obliquely towards the left Arm. They ſend out ſeveral branches both from their *lower* and *upper* ſide.

2. Intercoſtalis ſuperior.

From the *lower* proceeds the *ſuperiour Intercoſtal*, which runs along the interſtices or intervals of the four uppermoſt Ribs, and ſends ſlips to the neighbouring Muſcles and ſpinal Marrow. Theſe ſometimes are propagated from the cervical Arteries, coming out through the holes of the *Vertebræ*.

3. Mammaria.

From the *upper* ſide of each ſubclavian ſprings firſt *Mammaria*, which deſcends towards the Breaſts through the Muſcles that fill up the interſtices of the cartilages of the true Ribs; and a conſiderable branch of each deſcending out of the *Thorax* by the ſides of the *Cartilago enſiformis*, run down the *Abdomen* under the *Muſculi Recti*, ſpreading there into many twigs: which are ſaid to inoſculate with the extremities of the like twigs of the epigaſtrick Artery aſcending. But that opinion is ſo oppoſite to the circulation of the Blood, that it is impoſſible to be true. For no Blood can aſcend by the *Mammariæ*, nor deſcend by theſe aſcending twigs of the *Epigaſtricæ*.

4. Cervicalis. The next is *Cervicalis* (otherwiſe called *Vertebralis*) which ſendeth ſlips to the *Vertebræ* and Muſcles of the Neck, at whoſe ſeventh *Vertebra* it enters in by the holes of the tranſverſe proceſſes, and pierceth the Membrane that inveſts the ſpinal Marrow, beſtowing twigs both on the Membrane and Marrow, and runs up therewith in at the great hole of the *Occiput*, and being enter'd the Skull, both branches (the right and left) join under the *medulla oblongata*, and then are divided into innumerable moſt ſmall twigs, which make wonderful net-like *Plexus* in the *Pia Mater* about the *Cerebellum*, and run into the ſubſtance of the *Cerebellum* it ſelf; and ſome of them being united with thoſe of the *Carotides* make part of the very *Rete mirabile*.

5. Muſcula. The third Artery that riſes out of the *upper* ſide of the ſubclavian is *Muſcula*, which is ſpent on the Muſcles of the Neck, and ſometimes alſo on ſome of the Arm.

After the *Subclavians* have had all theſe pairs of Arteries going out of them, they paſs out of the *Thorax*, and begin to be called *Axillar*, of which in Book IV. Chap. 2.

Carotides. At the ſame place, or very near, where the aſcending Trunk of the *Aorta* ſends out the Subclavians ſide-ways, the remainder of it is divided into two, called *Carotides*, which aſcend directly upwards, (though the right ſometimes ariſes from the right Subclavian.) Theſe at their riſe are ſuſtained by the *Thymus*, and having beſtowed twigs on the *Larynx*, Tongue, the Muſcles of the *Os hyoides* and the neighbouring Glands, paſs up on each ſide by the ſides of the Wind-pipe to the Jaws with the internal Jugular Vein, and there are each ſubdivided into the *external* and *internal* branches.

The *external* is ſmaller, and is diſperſed into all the Muſcles of the Cheeks, Fore-head, Temples, Lips; and in general, through all the outer parts of the Head and Face.

The *internal*, which is larger, ſends firſt ſome more twigs to the *Larynx*, Tongue, *&c.* as alſo to the Glands behind the Ears, and the ſpongy parts of the Palate and Noſe. Then it entreth the upper Jaw, and beſtows a ſmall ſlip on the root of each Tooth (as the *external* did on the roots of the Teeth of the lower Jaw) whereby ſharp humours flowing in upon them ſometimes cauſe a very painful Tooth-ach. The remainder of it climbs upon the Skull, being about its *baſis* divided into two branches. The *leſs* and hinder, whereof having ſent one ſlip to the inner Muſcles of the Neck, and another through the hole of the uppermoſt *Vertebra* into the Membrane that inveſts the ſpinal Marrow, aſcending further enters the Skull at the hole by which the ſixth pair of Nerves (commonly ſo called) comes out, and creeping along the *Dura Mater* ends near its *Sinus*, (which yet ſome ſay it enters.) The *larger* branch, tending upwards, is carried through the bony chanel in the wedge-like bone with a winding duct to the *Sella equina*; at whoſe *baſis* after it has ſent out a twig on each ſide into the *Dura Mater*, it opens it ſelf into many ſmall ſlips, which being interwoven with thoſe of the cervical Artery (above-mentioned) make the *Rete mirabile*, which is more obſervable in Beaſts than in Men. Yet it is not all ſpent on the ſaid ſlips, but perforating the *Dura Mater*, it enters the *Pia Mater* with two notable branches, which being divided into very ſmalls twigs are mingled with thoſe of the cervical Artery, with which they paſs out of the Skull and accompany the ſpinal Marrow even to the Loins. Afterwards it ſends a ſmall branch through the ſecond hole of the wedge-like Bone with the optick Nerve, out of the Skull, to the Eye. And yet ſtill ſupplying more twigs to the ſubſtance of the Brain and *Pia Mater*, and being united with ſome other twigs of the cervical Artery, it makes the *Plexus choroides*.

The branches of the Trunk deſcending.

The *deſcending* trunk of the *Aorta*, which is larger than the *aſcending*, goes down by the Gullet, to which it cleaveth. And hence is a Man that is hot, ſo much cooled with a draught of cold drink; for the Gullet being cooled thereby, the Blood in the *Aorta* contiguous to it muſt needs be cooled likewiſe.

1. Intercoſtalis inferior.

Before it arrive at the Diaphragm it ſends out of its hinder ſide the *inferiour Intercoſtals*, which run along the interſtices of eight or nine of the lower Ribs, namely thoſe which the *ſuperiour Intercoſtals* did not ſupply. They likewiſe ſend ſprigs by the holes of the *Vertebræ*, made for the Nerves, to the Marrow of the Back, and to the Muſcles which reſt upon the *Vertebræ*, and alſo to thoſe of the *Thorax*. Sometimes above this and ſometimes below it, there ariſes alſo out of the hinder part of the *Aorta*, an Artery called *Bronchialis*, firſt found out and ſo named by *Frederick Ruyſch*, which accompanies all the *Bronchia* of the Wind-pipe.

2. Phrenica.

When it comes to the Midriff, there ſpring out of it the *Phrenicæ*, one on each ſide: theſe running all through the Diaphragm, paſs up into the *Mediaſtinum*;

Mediaſtinum, and ſometimes into the *Pericardium*.

3. Cœliaca.

Then having penetrated the Midriff it deſcends in one trunk to the fifth *vertebra* of the Loins; in which paſſage it firſt ſendeth forth *Cœliaca* which ariſeth ſingle, and is ſo called, becauſe it ſendeth twigs to the *Stomach*. This ſpringeth from the fore-part of the Trunk, at the firſt *vertebra* of the Loins, and deſcending under the hollow of the Liver, upon the Trunk of the *Vena Portæ* it is divided into two branches, the *right* and *left*.

Its branches.

Gaſtrica dextra.

Cyſticæ gemellæ.

The *right* which is ſmaller, aſcending, produces in its *upper* part the *Gaſtrica dextra*, that comes to the *Pylorus*, whence *Spigelius* calls it *Pylorica*. And beſides, the *Cyſticæ gemellæ*, which are very ſmall, and are diſperſed through the Gall-bladder. And out of its *lower* ſide there ſpring out of it,

1. *Epiploïs dextra*, which runs thro' the right ſide of the inner or hinder leaf of the Caul and the *Colon* that it is annexed to. Epiploïs dextra.

2. *Inteſtinalis*, beſtowed on the *Duodenum* and beginning of *Jejunum*. Inteſtinalis.

3. *Gaſtroëpiploïs dextra*, on the right ſide (to the middle) of the bottom of the Stomach, and alſo on the Caul that is knit to its bottom. Gaſtroëpiploïs dextra.

4. *Hepaticæ*, which are two ſmall ones: theſe are ſpent on the inveſting Membrane of the Liver (for its *Parenchyma* is nouriſhed by the *Porta*) the *Capſula communis*, the Gall-bladder and *Porus bilarius*. Hepaticæ.

The remainder of this *right* branch enters the Meſentery with many twigs.

Splenica.

The *left* branch of the *Cœliaca*, which is called *Splenicus* (ſometimes ſpringing immediately from

Gaſtrica major.
Coronaria ſtomachica.
Gaſtrica ſiniſtra.
Epiploïs poſtica.
Epiploïs ſiniſtra.

the *Aorta*) is larger than the right, and as it goeth towards the Spleen it ſendeth forth of its *upper* ſide *Gaſtrica major*, which after it hath beſtowed a ſlip on the upper and middle part of the Stomach, is divided into two others; the firſt whereof is called *Coronaria ſtomachica*, which encompaſſes the upper orifice of the Stomach like a Garland, and ſends many twigs to the body of the Ventricle it ſelf; the other *Gaſtrica ſiniſtra*, which (according to *Diemerbroeck*) is carried towards the right hand into the upper part of the Stomach and to the *Pylorus*. Out of its *lower* ſide ſpring, firſt *Epiploïs poſtica*, which runs to the hinder leaf of the *Omentum*, and the *Colon* annexed to it; ſecondly *Epiploïs ſiniſtra*, which is beſtowed on the lower and left ſide of the *Omentum*.

Vas breve arterioſum.
Gaſtroëpiploïs ſiniſtra.

Juſt as this ſplenick branch is entring into the Spleen, there ariſe out of its upper part *Vas breve arterioſum*, which goeth ſtreight to the left part of the bottom of the Stomach; and the *Gaſtroëpiploïs ſiniſtra*, which being ſuſtained by the upper or fore-leaf of the *Omentum* ſends ſome twigs thereto, and alſo to the left part of the bottom of the Stomach, and to both its fore and hinder ſides. Then it enters into the Spleen, whoſe branchings therein we deſcribed in the former Book, Chap. 16. *Of the Spleen.*

All theſe Arteries ſpring from the *Cœliaca*, and accompany the Veins of the *Porta* of the like Denomination.

[illegible]

The next that ariſes out of the trunk of the *Aorta* is the *upper Meſenterick*, which ſprings from the fore-part of it as the Cœliack did. It accompanies the *Vena meſaraica* of the *Porta*, and runs through all the upper part of the Meſentery, and beſtows many branches on the Guts, *Jejunum*, *Ileum* and that part of *Colon* that lieth in the right Hypochondre.

5. Emulgentes. Immediately below this, about the ſecond *vertebra* of the Loins, there go out of each ſide of the deſcending trunk of the *Aorta* an *Emulgent Artery*, each of which being after its riſe divided into two and ſometimes three branches, enters the Kidney of its own ſide. The right ſprings out of it a little lower than the left. Both are ſubdivided into innumerable twigs in the *Parenchyma* of the Kidneys, (all of which are inveſted with the Veins in one common *capſula* borrowed from the *Pelvis*) and their Capillaries end in the Glands, wherein the *Serum* that theſe Arteries bring with the Blood is ſeparated therefrom, and carried from them by the urinary Siphons into the *Pelvis*, of which more in the former Book, Chap. 17. *Of the Kidneys.*

6. Spermaticæ. Next to theſe ariſe the *Spermaticæ* (called *Arteriæ præparantes.*) Theſe go out of the fore-part of the Trunk very near together (very ſeldom either of them out of the Emulgents, as the left Spermatick Vein does) and the right paſſes over the trunk of the *Vena cava.* About two fingers breadth from their riſe they are each joined with the *Vena præparans* of their own ſide, and deſcend with them in *Men* through the proceſs of the *Peritonæum* to the Stones, being divided into two branches a little before they arrive at them, one of which runs under the *Epididymis*, and the other to the *Teſtis.* In *Women*, when they come near the *Teſtes*, (or *Ovaria*) they are divided alſo into two branches, one whereof goes to the *Teſtis*, and the other to the bottom of the Womb.

Next

7. Meſenterica inferior. Next below the Spermaticks ſprings the *lower Meſenterick* out of the Trunk a little before it is divided into the *Rami iliaci.* This entreth the lower region of the Meſentery, and diſtributes many branches to the left part of the *Colon* and to the ſtreight Gut, and laſtly deſcending to the *Anus*, makes the internal hemorrhoidal Artery.

8. Lumbares. Very near to this, out of the Trunk ſtill, ariſe the *Lumbares*, reckoned four in number. Theſe go out of the backſide of the *Aorta*, and are diſtributed not onely to the neighbouring Muſcles of the Loins, and to the *Peritonæum*, but enter in at the holes of the *vertebræ* of the Loins, and run along the Membrane that involves the ſpinal Marrow, and penetrate into the Marrow it ſelf.

Beſides theſe ſome reckon other two, on each ſide one, called *Muſculæ ſuperiores*, (which run to the Muſcles of the *Abdomen*) unleſs theſe be two of the four called *Lumbares*.

When the Trunk is deſcended as low as the fifth or laſt *vertebra* of the Loins and the top of *Os ſacrum*, it begins to climb upon the *Vena cava*, under or behind which it paſſed thus far. But as it begins to get upon it, it is divided into two

Rami iliaci. equal branches called *Rami iliaci*, and at its very diviſion there ſprings out of it *Arteria ſacra*, whoſe ſmall twigs entring in at the holes of *Os ſacrum* penetrate into the Marrow contained in it.

Their branches. The Trunk of the deſcending *Aorta* being divided into the *Rami iliaci*, theſe are ſubdivided preſently into the *interiour* and *exteriour* branches.

From the *interiour*, which is leſs, proceed three others.

1. Muſcula inferior. Firſt, the inferiour *Muſcula* (called otherwiſe *Glutæa*) which is beſtowed on the Muſcles named

Glutæi that make the Buttocks, and alſo on the lower end of the Iliack Muſcle and the *Pſoas.*

Secondly, The *Hypogaſtrick*, which is large, 2. Hypogaſtrica. and at the lower end of *Os ſacrum* runs to the Bladder and its Neck, and the Muſcles that cover the *Oſſa pubis.* In *Men* it goes alſo along the two nervous bodies of the *Penis* as far as the *Glans:* and in *Women* it is diſtributed in numerous branches into the bottom of the Womb and its Neck, out of which for the greateſt part iſſue the *Menſes* in their monthly purgation. It goes alſo to the *Podex*, where it makes the external hemorrhoidal Artery.

Thirdly, The *Umbilical* Artery, which aſcend- 3. Umbilicalis. ing by the ſides of the Bladder, and being inſerted into the *Peritonæum*, proceeds betwixt the two membranes thereof to the Navel, out of which it paſſes in a *Fœtus* in the Womb, and runs into the *Placenta uterina*, of which before, *Book* I. *Ch.* 33. But after the Infant is born, when there is no more uſe of it, it cloſes up, and turns into the nature of a Ligament, in ſome meaſure ſuſtaining the ſides of the Bladder, and hindring it from preſſing on its Neck.

From the *exteriour branch* of the *Ramus iliacus* two Arteries ariſe.

Firſt, The *Epigaſtrick*, which turning upwards 4. Epigaſtrica. on the outſide of the *Peritonæum* runs betwixt it and the *Muſculi recti* of the *Abdomen* as high as the Navel, where the Mammary Artery meets it, and according to tradition (though falſe) inoſculates there with it. Of which before, in this Chapter.

Secondly, *Pudenda*, which ſends forth a nota- 5. Pudenda. ble Artery on each ſide into the nervous body of the *Penis* in Men, and into the *Clitoris* in Women.

Hence it is carried inwards by the jointing of the *Oſſa pubis* to the *Pudenda* and Groins, and their Glands, and is ſpent on the Skin of thoſe parts, and of the Yard (in Men.)

When all theſe pairs of Arteries have ariſen out of the *Rami iliaci*, they run down out of the *Abdomen* to the Thighs, where they begin to be called *Crurales*, where we ſhall leave them till we come to ſpeak of the Arteries of the *Limbs*, *Book* IV. *Chap.* 5.

Having now traced all the Arteries ſpringing out of the *Aorta* (whether out of its *aſcending* or *deſcending* Trunk) in the *Thorax* and *Abdomen*, taking occaſion to do ſo, becauſe the *great Artery* out of which they all ariſe, has its Origine in the *Heart*, to which we have conſidered it as an Appendage; we ſhall paſs on to the deſcription of the remaining parts in the *Breaſt*, not yet ſpoken to.

Tab. XI.

Repreſenteth the Fibres of the Heart, with its Auricles, Ventricles, Valves, &c. *(from Dr.* Lower.*)*

Fig. I. Sheweth the outmoſt or ſtreight Fibres of the Heart.

a *The Baſis of the Heart.*
b *Its Cone.*
ccc *The ſtreight Fibres tending upwards towards the baſis.*

Fig. II. Sheweth the ſecond rank of Fibres (which are oblique) lying next under the former, which aſcending obliquely from the left ſide towards

Tab. XI. Pag. 332

Fig. 1

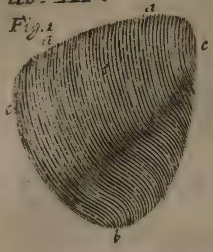


Fig. 2

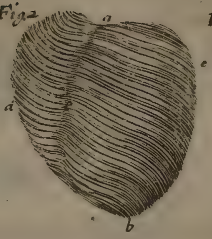


Fig. 3

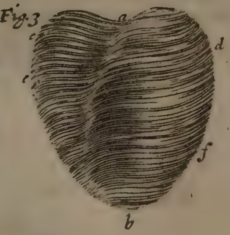


Fig. 4

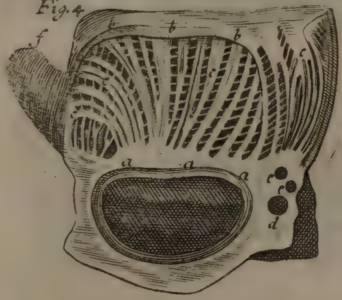


Fig. 5

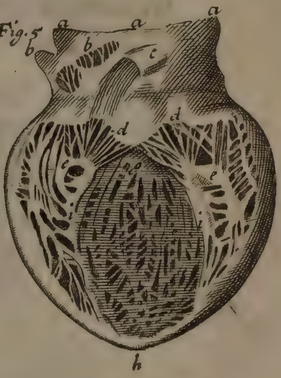


Fig. 6

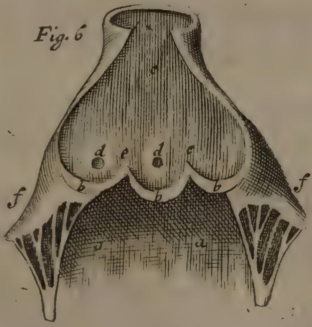
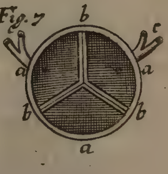


Fig. 7



towards the right, terminate in the baſis of the Heart, imitating a Snail-ſhell, or Screw, by their ſpiral circuit.

a *The Baſis of the Heart.*
b *The Cone.*
c *The Fibres that encompaſs the left Ventricle.*
d *The Fibres encompaſſing the right.*
e A Sinus *in the interſtice of the Ventricles, made for receiving the Veſſels of the Heart.*

Fig. III. Sheweth the third or inmoſt rank of Fibres, which are oblique alſo, but run a contrary courſe to the former; for they ariſe every where from the right ſide of the Heart, whence being carried obliquely towards the left, and embracing each Ventricle of the Heart they aſcend to the Baſis of the left ſide.

a *The Baſis of the Heart.*
b *The Cone.*
c *The right ſide of the Heart.*
d *The left.*
e *The Fibres of the right Ventricle.*
f *The Fibres of the left.*

Fig. IV. Shews the right Auricle of the Heart inverted and laid open.

aaa *The Baſis of the Auricle, where it is united to the Tendon of the Heart.*
bbb *The tendinous Circle whereby it is diſtinguiſhed from the* Vena cava.
ccc *The carnous Fibres which are carried to the diverſe or oppoſite Tendons.*
d *The Coronary Vein.*

ee *Other leſſer Veins appointed for bringing back the Blood which remains from the nutrition of the Heart.*
f *The upper part of the Auricle.*

Fig. V. Shews the inner *Sinus* of the left Ventricle.

aaa *The pulmonary Vein laid open before its entrance into the Heart.*
b *The left Auricle of the Heart.*
c *The* Foramen ovale, *whereby the Blood flows out of the* Vena cava *into the pulmonary Vein juſt before the door of the left Ventricle.*
dd *The two Mitral Membranes or Valves.*
ee *The fleſhy Columns protuberating out of each ſide of the Ventricle.*
g *The place under the Mitral Membranes where the Blood is ſent forth into the* Aorta.
h *The Cone of the Heart.*
iii *The carnous Fibres running on every ſide through the whole circuit of the inſide of the Ventricle.*

Fig. VI. Sheweth the ſemilunar Valves at the riſe of the *Aorta* out of the left Ventricle, (whereunto thoſe at the riſe of the pulmonary Artery out of the right Ventricle are like.)

aa *Part of the left Ventricle laid open.*
bbb *The three ſemilunar* Valves *conciding looſly that they may yield an Exit to the Blood burſting forth.*
c *The Trunk of the* Aorta *laid open.*
dd *The two coronary Arteries riſing immediately without the ſemilunar* Valves.
ee *The root of the* Aorta *where it is united with the Tendon of the Heart.*

ff *The Mitral Membranes divided and turned back on each ſide, that the ſemilunar* Valves *may come into ſight.*

Fig. VII. Shews the ſemilunar Valves cloſed.

aaa *The Trunk of the* Aorta *cut off at the root.*
bbb *The three ſemilunar* Valves *coming cloſe to one another, and hindring the recourſe of the Blood out of the* Aorta *into the Ventricle.*
cc *The two coronary Arteries.*

CHAP. XII.

Of the Aſpera Arteria *and Lungs.*

The Wind-pipe.

AS in the Firſt Book, being to treat of the *Stomach*, we firſt deſcribed the *Gullet*, which ſerves as a Tunnel to it; ſo the ſame reaſon induces to begin with the *Wind-pipe*, called *Trachea* or *Aſpera Arteria*, thereby to uſher in the deſcription of the *Lungs*, to which it performs the ſame office as the *Gullet* to the *Stomach*, this receiving in Air, as that does Meat and Drink.

Its Figure and Subſtance.

The *Aſpera Arteria* then is a long Pipe, conſiſting of Cartilages and Membranes, which beginning at the Throat or lower part of the Jaws and lying upon the Gullet deſcends into the Lungs through which it ſpreads in many branchings.

Parts. 1. Larynx.

It is commonly divided into two parts, the upper which is called *Larynx*, and the lower, that is named *Bronchus*. Of the former we ſhall ſpeak in Chap. 14. where we ſhall treat of the parts contained in the Neck; of the other, here.

2. Bronchus. By the *Bronchus* we mean all the *Trachea* beſides the *Larynx*, as well before as after it arrive at the Lungs. It is joyned immediately to the *Larynx*, to whoſe loweſt Cartilage all thoſe of the *Bronchus* (ſo far as it reſts upon the Gullet) are aſſimilated. *Its Cartilages and Membranes.* Theſe Cartilages are like ſo many Ribs, Hoops or Rings, ſeated one below another at equal diſtances, and kept in their places by the *inner* Membrane of the *Trachea*, which fills up their Interſtices and tyes them one to another like a Ligament. Yet theſe Rings have not their circle intire, but on the back-ſide of the *Bronchus* next the Gullet, that they might give way to the Meat in ſwallowing, they paſs into a Membrane, which is the ſame with the inner Membrane that tyes them together. So that they are in figure like the letter C. But this Interſtice in their circle which moſt Anatomiſts affirm to be membranous, *Caſp. Bartholin* (after his Father) ſays is rather "carnous, for there are very plain "and remarkable carnous Fibres that run from "one ſide or end of the Cartilage acroſs to the "other, which in expiration (eſpecially violent) "contracting themſelves draw the ends of the "Cartilages towards one another on each ſide, "and thereby ſtraiten the Pipe of the *Trachea*.] And though the Cartilages ſo far as they are contiguous to the Gullet, are thus ſemilunar as it were; yet thoſe of the branches of the *Bronchus* within the Lungs have no Interſtice in their circumference, being all cartilaginous, though not all of a circular figure, but ſome four-ſquare, others triangular, &c. as *Diemerbroeck* obſerves. This *inner* Membrane is plentifully beſet with miliary Glands, out of which a good part of that mucous matter that bedaubs its inſide iſſues, for

the lubricating of it. The *outer* Membrane helps to connect the Cartilages the more firmly one to another, and the whole *Trachea* to the neighbouring parts, that it may more ſafely and firmly deſcend into the *Thorax.* This is much thinner than the other: for the inner (according to Dr. *Willis*) has two rows of muſcular Fibres, the outer ſtreight, the inner oblique; the firſt by their contraction ſhorten the *Trachea*, the latter ſtraiten it; ſo that he thinks they aſſiſt expiration, eſpecially when it is violent, as in coughing, hawking or the like. Yea he ſays, this inner Membrane has two others growing upon it as it were, one glandulous, and another vaſcular. Through this latter do the Blood-veſſels and Nerves every where run; and the Glands placed in the former receive and keep all the ſuperfluous moiſture or *lympha* depoſited by the Arteries which the Veins do not imbibe, till they can remand it by the Lympheducts (which ſpring from them;) or if it be over-plentiful, ſo that the Lympheducts cannot receive it all, then it iſſues both out of theſe Glands and out of the Arteries into the Cavity of the Wind-pipe and cauſes a Catarrh. But the inſide of this Membrane is naturally moiſt, being beſmear'd with a fattiſh and mucous humour, to hinder its drying, and to make the voice ſmoother; ſo that when this humour is fretted off in Catarrhs, or the inſide of this Membrane becomes rough from any cauſe, the voice becomes hoarſe; and when it is dried by too much heat, as in Fevers, it becomes ſqueaking.

The *aſpera Arteria* has *Veins* from the external *Veſſels,* Jugulars. *Arteries* from the *Carotides*, and from the *Arteria bronchialis*, (firſt found out by *Frederick Ruyſch*) which ſprings from the backſide within outwards; for if one fill the Lungs newly taken out of a Sheep or the like (before they are cold) with a pair of Bellows, never ſo full of wind, there will none paſs out of the Membrane, not ſo much as to make the flame of a Candle to wave: but on the other ſide they do admit even liquors to paſs from without inwards; ſo when the Breaſt has been opened to let out matter in an *Empyema*, (which was too thick to be abſorbed by the too narrow pores) and bitter cleanſing injections have been ſquirted into the cavity of the *Thorax*, to clear it from the purulent matter ſtagnating in it, it has been obſerved that a good part of ſuch injections have been hawk'd and cough'd up. And though ſome think that whenſoever *Pus* is cough'd up, it is certainly bred in the Lungs themſelves; yet I am of opinion that in an *Empyema* when it is thin, theſe Pores may be ſo large as to imbibe it even out of the cavity of the *Thorax*; otherwiſe I ſee not how any labouring of an *Empyema* ſhould ever be cured without tapping; for of the two I think this a far more probable way to diſcharge the matter by, than that it ſhould be imbib'd by the mouths of the Veins gaping (as is ſuppos'd) either in the *ſuperficies* of the *Pleura* or Diaphragm. But to proceed.

Diviſion. The Lungs are *divided* into the right and left part, being parted by the *Mediaſtinum*, and each part is otherwiſe called a *Lobe*. And becauſe they are two, that have no communication one with the other (ſave in one common trunk of the *Trachea*, by which the Air comes into and goes out of them) hence in common ſpeech we ſay *Lungs* in the plural. Each of theſe parts or Lobes is ſubdivided into two, ſometimes three others, and thoſe into many leſſer Lobules, as may be ſeen in the following Figure taken from Dr. *Willis.*

Connexion.

The Lungs hang looſe in the cavity of the *Thorax*, being ſuſpended by the *Aſpera Arteria* that runs every where through their ſubſtance, and is it ſelf ſuſtained by its connexion to the parts of the Neck. Preternaturally (though pretty often) they cleave by their outer *ſuperficies* to the *Pleura*, and ſometimes with their lower end to the Diaphragm.

Veſſels. 1. Trachea.

They have all ſorts of *Veſſels*, that are common to them with other parts; but peculiar to themſelves they have *Bronchia* or the branches of the Wind-pipe, for bringing in and carrying forth of Air.

2. *Arteries and Veins.*

Their *Arteries* and *Veins* are the *Arteria* and *Vena pulmonaris*, that accompany all the Diviſions of the *Aſpera Arteria* within their ſeveral Lobes. Theſe are ſaid to have many Anaſtomoſes one with another, for the readier Circulation of the Blood through the Lungs; however, they are admirably interwoven one with another all through the coats of the *Veſiculæ*. But of theſe we diſcourſed ſo largely before, *Chap.* 10. that we ſhall ſay no more of them here. Beſides theſe, that were all the ſanguiferous Veſſels Anatomiſts had obſerved to reach to the Lungs, there has of late been found out an Artery by *Frederick Ruyſch* (which he calls *Arteria bronchialis*) that ſeems to convey Blood for the nouriſhment of the Lungs and *Bronchia*. But of this likewiſe before (in this *Chapter.*)

3. *Lymphe-ducts.*

They have abundance of *Lympheducts* that attend upon the Veins and Arteries. Their ſmall twigs running upon the outer *ſuperficies* of the

Lungs, towards their Root unite into ſeveral greater Trunks; which being inſerted into the common thoracick Duct, diſcharge thereinto the *Lympha* imbibed by them in the Lungs. They may be made to appear very plain in the outward ſurface, if in diſſecting a live Dog, one preſs upon the top of the thoracick Duct, ſo as nothing be poured from thence into the Subclavian Vein: for then the Lympheducts of the Lungs, ſeeing they cannot unload themſelves into the common Duct that is now ſtopt and full, will ſwell very much, and be very conſpicuous. If theſe Lympheducts at any time be obſtructed or broken, Dr. *Willis* thinks there often proceeds from thence a Dropſie of the Breaſt or Lungs; yea, Coughs and Phthiſical Diſtempers.

4. *Nerves.* The laſt ſort of Veſſels diſperſed in the Lungs are the *Nerves.* And theſe proceed from the recurring Nerves of the *Par vagum*, uſually called the ſixth Pair, but Dr. *Willis*'s eighth, who ſays they are diſtributed all over the Lungs along with the ſanguiferous Veſſels and Ducts of the *Bronchia*, to ſupply Animal Spirits to the muſcular Fibres of their Coats.

The *Action* to which they contribute is Reſpiration, of which in the next Chapter.

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Tab. XII

Fig. I.

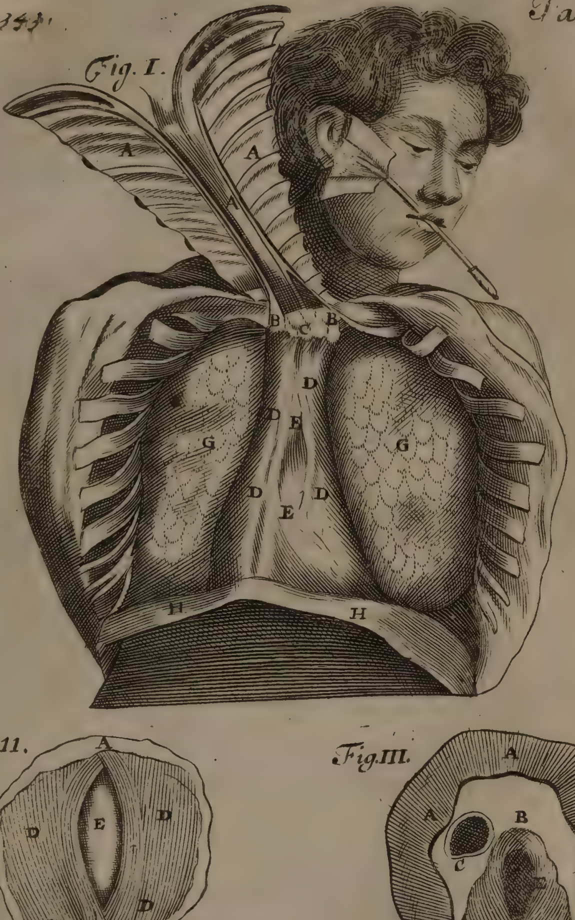


Fig. II.

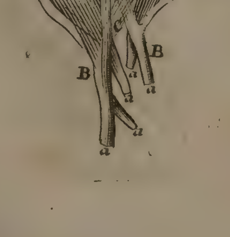
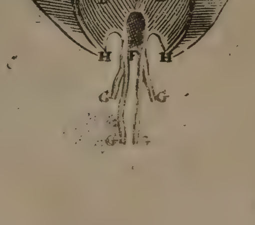


Fig. III.



Tab. XII.

Repreſenteth the Lungs, *Diaphragm*, Ductus ſalivalis, *&c.*

Fig. I. Repreſenteth the *Sternum* cut off and lifted up, the *Mediaſtinum*, *Thymus*, Lungs, Diaphragm, *&c.*

AAA *The inner ſuperficies of the* Sternum *and of the Cartilages knit to it.*
BB *The mammary Veins and Arteries deſcending under the* Sternum.
C *The glandulous Body called* Thymus.
DDDD *The ſides of the* Mediaſtinum *pull'd aſunder from the* Sternum.
EE *The ſpace between the Membranes of the* Mediaſtinum, *ariſing from the tearing of it from the* Sternum.
GG *The Lungs.*
HH *The Diaphragm.*
I *The* Cartilago enſiformis.
K *The external ſalival Duct.*

Fig. II. Shews the Diaphragm of a Dog (very little differing from that of a Man) from *Caſpar Bartholin.*

AAA *Shew the courſes of the carnous Fibres in the upper or fore Muſcle, which run ſtreight from the Ribs to the Centre or tendinous part of the Diaphragm.*
B *The Centre or tendinous part.*
C *The hole in the right ſide of the tendinous part for the tranſit of the aſcending Trunk of* Vena cava.

DD *The lower or hinder Muſcle of the Diaphragm.*

E *The hole in the upper part of the lower Muſcle through which the Gullet deſcends.*

F *The hole in the hinder part of the lower Muſcle through which the* Aorta *deſcends.*

GGGG *Its tendinous extremities whereby it adheres to the* Vertebræ *of the Loins, formerly called its proceſſes.*

Fig. III. Shews the lower or hinder Muſcle of a Man's Diaphragm, ſomething differing from that of a Dog, (from the ſame Author.)

A *Shews the Tendon that intervenes betwixt the upper and lower Muſcle, commonly called the nervous Centre of the Diaphragm.*

BB *The lower Tendons (commonly called its proceſſes) which ariſe by five Heads as it were* (aaaaa) *from the* Vertebræ *of the Back and Loins.*

C *The hole by which the* Aorta *(lying along the* Vertebræ *of the Back and Loins) deſcends.*

DDDD *The fleſhy Fibres of the lower Muſcle in their natural and proper Courſe.*

E *The hole in its carnous part by which the Gullet deſcends.*

CHAP.

CHAP. XIII.

Of Reſpiration.

The Action of the Lungs.

THE *Action* to which the Lungs are appointed by Nature to miniſter, is *Reſpiration*, which is an alternative *Diaſtole* and *Syſtole*, or dilatation and contraction of the Breaſt, whereby the Air is received in, and driven forth of the Lungs.

How Reſpiration is performed.

In dilatation, whereby *inſpiration* is performed, the Lungs are purely paſſive; for they do not at all dilate themſelves by any proper power or faculty of their own, being deſtitute of inſtruments to perform ſuch an action, (*viz.* Muſcles;) neither do they attract the Air by any magnetick property: But the Muſcles of the *Thorax* being ſo framed, that tho' contraction be the only and proper action of a Muſcle, yet the *Thorax* is dilated by certain of them, as it is contracted by others; whilſt it is dilated, there is greater ſpace given for expanding the Lungs, and then the Air partly by the preſſure of the Atmoſphere, and partly by its proper elaſtick Virtue iſſues in at the *Trachea*, and inſinuates it ſelf into all its *Bronchia*, and through them into the *Veſiculæ*, and puffs them all up. The manner whereof is very ingeniouſly expreſt by Dr. *Mayow.* " Namely ſeeing the Air " thro' the weight of the ſuperincumbing Atmo- " ſphere does not only ruſh into all empty places, " but alſo ſtrongly preſſes upon whatſoever things " are next it; it follows that the Air which is " continued thro' the Noſtrils and *Trachea* even " to the *Bronchia* or entrance of the Lungs, doth

“ bear upon the Lungs from within, and endeavour
“ an entrance into them. Whence it comes
“ to paſs, that, whilſt the inſides of the *Thorax*
“ (which by compreſſing the Lungs from without
“ reſiſted the preſſure of that Air) are drawn outwards
“ by the Muſcles of the Breaſt that are appointed
“ for its dilatation, and the width of the
“ *Thorax* is enlarged, that Air which is neareſt
“ adjacent to the *oſtia* of the *Bronchia* (all obſtacles
“ being now removed) ruſhes into the cavities
“ of the Lungs with all the preſſure of the Atmoſphere,
“ and puffing them up, occupies and
“ fills the widened ſpace of the *Thorax*. Nor does
“ the preſſure of the Atmoſphere alone, avail
“ to inſpiration; but the Elaſtick Power of the
“ Air alſo, whereby it endeavours to extend it ſelf
“ *in immenſum*, is aſſiſting to the ſame. For the
“ Air, eſpecially that which is neareſt the earth,
“ is compreſſed by the weight of the ſuperincumbent;
“ whence it always endeavours to free it
“ ſelf from that preſſure, much like as a fleece of
“ wooll, when the force that compreſs'd it is taken
“ away, by a certain motion of reſtitution preſently
“ ſpreads and enlarges it ſelf. Which may
“ be confirmed by this known Experiment, *viz.*
“ If a Bladder, out of which the Air is firſt in a
“ great meaſure preſſed, be tyed ſtraitly about its
“ ſphincter (or neck) and put into a glaſs, and then
“ the Air be drawn out of that glaſs, the Bladder
“ will preſently begin to ſwell and puff up to its
“ firſt dimenſion. The reaſon whereof is, That
“ the Air that was in it, though little, when the
“ external Air (from whoſe preſſure the ſame was
“ driven into a narrow ſpace) is removed, preſently
“ expands it ſelf and puffs up the Bladder,
“ yea, ſometimes burſts it with violence. Juſt

“ thus is the inflation of the Lungs cauſed in in-
“ ſpiration : for aſſoon as the ſides of the *Thorax*
“ (which by compreſſing the Lungs make them
“ concide) are drawn outwards, the Air that is
“ at the entrance of the Lungs, whether through
“ the preſſure of the Atmoſphere, or becauſe of
“ its own Elaſtick Virtue, is preſently thruſt in-
“ to the Lungs and diſtends them.] But in *Expiration* (or the contraction of the *Thorax*) the Air is not only driven forth of the Lungs by the compreſſion of the *Thorax*, but alſo by the contraction of the muſcular Fibres of the *Veſiculæ* and of the inner coat of the *Trachea* and its *Bronchia*.

Muſcles miniſtring to Reſpiration.

The *Muſcles* that aſſiſt the dilatation of the Breaſt, are thoſe that lift up the Ribs and draw them backwards ; which ſhall be deſcribed *Book* IV. *Chap.* 15. And beſides theſe there is another internal Muſcle, namely the Midriff, that contributes towards it, as was ſhewed *Chap.* 3. of this *Book*, where we treated of it. And as for the ſtraitning or concidence of the *Thorax*, that it is not onely a motion of reſtitution, or a ceſſation of the aforeſaid Muſcles from their action, is evident, ſeeing ſometimes Expiration is performed more laboriouſly and violently than inſpiration, as in coughing, hollooing, or the like : And therefore Nature has provided peculiar and proper Muſcles for that purpoſe, deſcribed in the ſame *Chapter* of the *Fourth Book* ; and theſe are aſſiſted partly by ſome Muſcles of the *Abdomen*, and partly by the muſcular Fibres of the *Veſiculæ* and *Bronchia*, as aboveſaid.

What kind of Motion Reſpiration is.

There hath been great Controverſie among Philoſophers, whether Reſpiration be an Animal or Natural Motion. That it is *natural*, is thought to be proved, both in that it is performed as well when we are aſleep, as awake; and alſo that though it be continued through a Man's whole life, yet we are never wearied with it as we are with animal and voluntary motions. On the other ſide, ſome prove it to be *animal*: firſt becauſe it is performed by ſuch Inſtruments as ſerve for animal Motion, namely Muſcles; and ſecondly becauſe at our pleaſure we can make it quicker or ſlower, ſtronger or weaker, or alter it how we pleaſe. Others thinking the Arguments on either ſide convincing, take both in, and ſuppoſe it a kind of *mixt* Action, partly natural, and partly ſpontaneous. But I think there is no neceſſity from the Arguments alledged to grant this motion to be *natural*, or any more than *animal* or *ſpontaneous*. For as to the *firſt* Argument, That the motion is as well performed when we ſleep as when we are awake, and therefore it cannot be voluntary; if this were allowed to be of force, we muſt alſo grant walking and talking to be natural motions, becauſe many perform them both, when they are aſleep. And as to the *ſecond*, from our not being wearied by it, in Anſwer to it we may diſtinguiſh of animal actions, into ſuch as are done by inſtinct and are free, and into ſuch as ſerve the affections of the mind: the former proceed always and without impediment, even when we think not thereon, but may notwithſtanding be directed and moderated when we *do* think of them, and ſuch is Reſpiration; the latter is not performed continually, as to run, leap, write, *&c.* In the former there is a plentifull and continual influx of animal ſpirits into the Muſcles, of cuſtome or courſe; whence there follows no wearineſs, though they be continual:

In the latter, ſeeing by the determination that is made in the Brain, the Spirits now flow in and anon ceaſe, ſometimes in greater plenty and ſometimes in leſs, from this mutation and unaccuſtomedneſs does the wearineſs proceed.

The uſe of it.

Reſpiration is ſo neceſſary to the continuance of life, that after once the *Fœtus* comes into the open Air and begins to breathe, it can hardly live two minutes without it. But upon what account it becomes ſo neceſſary is not agreed among learned Men, each party exhibiting ſuch reaſons of it, as may beſt ſuit with their Hypotheſes. Hence *ſome* (and thoſe the moſt) think that Reſpiration ſerves for the cooling and ventilating of the Blood that acquires a great heat in the right Ventricle of the Heart, and alſo for the carrying out fuliginous ſteams therefrom. *Others*, that it ſerves for the better mixture of the particles of the Blood as it paſſes through the Lungs. *Others*, that it condenſes the Blood, which was very much rarefied in the right Ventricle of the Heart, whereby it comes to take up leſs room in the Lungs, and paſſes the readilier through each Lobe into the left Ventricle. *Others*, that it principally ſerves for the Circulation of the Blood thro' the Lungs; For in Expiration all the *Bronchia* with the appendant *Veſiculæ* being in a great meaſure emptied of the Air, permit a free entrance of the Blood into the Lungs by the *Vena arterioſa* out of the right Ventricle of the Heart; but anon the ſaid *Bronchia* and *Veſiculæ* being filled again with Air, do compreſs the Veſſels of the Lungs, whereby the Blood that was received into them in Expiration, is ſqueezed out of the Arteries into the Veins, and ſo its Circulation thro' the Lungs promoted; whereas otherwiſe it would be apt to ſtagnate and occaſion a ſuffocation. Dr. *Mayow* thinks that a double benefit, chiefly, accrews by Reſpiration; *firſt*, That the Blood by the admixture of the Nitro-aereal Particles of the Air is fermented, and freed from coagulation; and *ſecondly*, that the ſame Nitro-aereal Particles being received into the Blood are carried to the Brain for the refection and ſupply of the Animal Spirits. Laſtly, Dr. *Willis*, Dr. *Charleton*, &c. think that the Air is drawn in for the greater ſubtilization of the Blood, and accending or continuing the vital Flame. Some other Opinions there are concerning the primary Uſe of Reſpiration, which we will not recite, as being leſs probable: and which of theſe produced is the moſt likely, we leave the Reader to judge, being unwilling to enter into the diſpute about ſo difficult a ſpeculation in this ſhort Anatomical Treatiſe.

Secondary Uſes of Reſpiration are, *firſt*, to form the Voice; and *ſecondly*, to miniſter to the Senſe of Smelling by drawing or ſnuffing up the vapours with ſome violence through the Noſtrils, without which the Organ of Smelling will ſcarcely be affected. Which Uſe Dr. *Needham* draws from Dr. *Lower*'s Experiment: who having cut a Dog's wind-pipe aſunder in his throat, and turn'd it outward (the wound being in other regards heal'd up again) ſo that the Dog took not his breath by his mouth or noſtrils, but altogether by his throat; found, that thereby he loſt not his Voice onely, but his Smelling alſo wholly, ſo that the moſt ſtinking Smells would not excite him.

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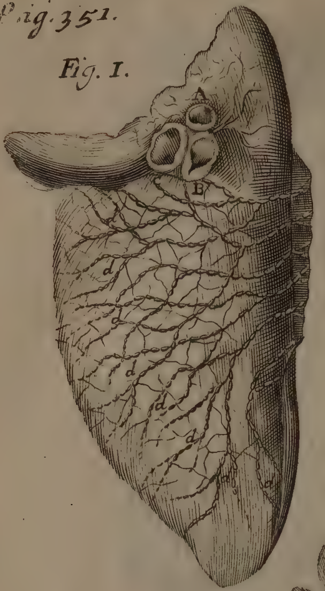
Tab. XIII

Fig. 1.



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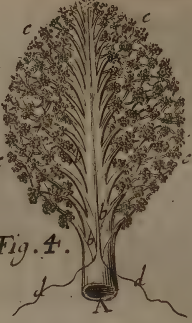
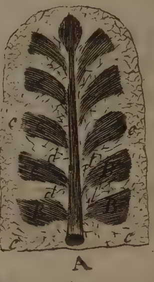


Fig. 3.



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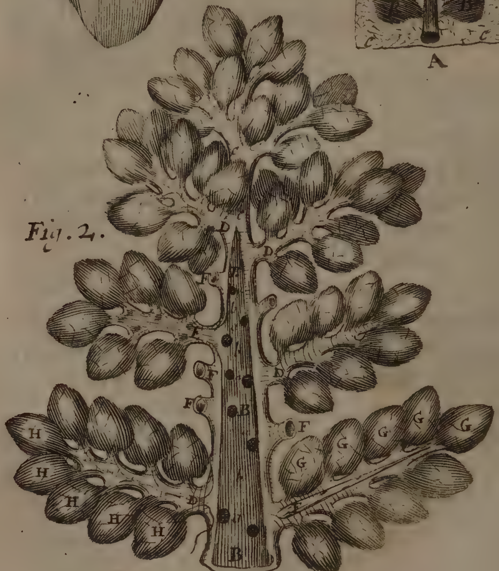

Tab. XIII.

Repreſenteth one Lobe of the Lungs, with its Lobules, Membranous Interſtices, &c. *from* Dr. Willis.

Fig. I. Sheweth one whole Lobe of the Lungs, in whoſe ſuperficies the Lympheducts appear creeping this way and that way.

A *The Orifice of the* Trachea *cut off, lying in the middle of the Veſſels.*
B *The Orifice of the ſubjacent Pneumonick Artery.*
C *The Orifice of the Pneumonick Vein lying upon the Artery.*
dddd, *&c. The outward Lympheducts diſperſed thro' the ſurface of this Lobe.*

Fig. II. Expreſſes one Lobe of the Lungs divided into ſmaller and very little Lobules, according to the Ramifications of the *Aſpera Arteria*, the Branchings and Off-ſprings of which Veſſel being firſt filled by a Liquor injected into them, and then ſevered from one another as to the Lobules, were drawn by the Life.

A *The Trunk of the* Aſpera Arteria, *cut from the reſt of its body.*
BBB *Its wider part cut open, that as well the Holes that lead into each Branch, as its ſtreight muſcular Fibres may be ſeen.*
aaa *The aforeſaid Holes leading into the Branches that are extended this way and that way.*

bbb *The ſtreight muſcular Fibres whereupon other circular ones lie.*

CC *The ſmaller end of this Trunk intire and ſhut, that the annular Cartilages may appear.*

DDDD *The Tracheal Branches, conſtituting the leſſer Lobules, intire and ſhut in that place; that the Annular Cartilages may likewiſe appear in them.*

EEEE *The like Branches cut open, that the Holes and ſtreight muſcular Fibres may be ſeen.*

FFFF *The Stumps from which the* Tracheal *Branches being cut are removed, that Room may be granted to the reſt expanding themſelves after their Diviſion.*

GGGG *The ſecondary Lobules hanging upon the ſtems of the* Bronchia *like Grapes, which may alſo be ſubdivided ſtill into leſſer Lobules, all whoſe inner Ducts paſs out of the* Bronchia *into the Veſiculary Cells.*

HHHH *The ſanguiferous Veſſels creeping through the ſuperficies of thoſe Lobules.*

Fig. III. Expreſſes a piece of a Pulmonary Lobe, wherein the membranous Interſtices being blown up, all the Lobules appear in their proper Figure, and ſomewhat repreſent a Leaf of Polypody.

AA *A piece of the* Aſpera Arteria *complicated with the reſt of the Veſſels, upon which, made up of them all, the Lobules grow like the Leaves of a Tree.*

bbbb *The Lobules themſelves.*

cccc *The Blood-veſſels creeping through them.*

dddd *The membranous Interſtices of the Lobules, through which the Blood-veſſels* eeee *alſo creep.*

Fig. IV. Repreſents the divarication of a Tracheal Branch diſtributed within one Lobule, and its Ramification into the Tubes and orbicular Bladders.

AA *The ſtem of the* Aſpera Arteria.
bbbb *The leſſer twigs proceeding from that ſtem.*
cccc *The tranſit of theſe twigs into the orbicular Bladders which ſeem like bunches of Grapes.*
dd *Sanguiferous Veſſels diſtinct from the Pneumonick, which creep upon the* Trachea *and ſerve to nouriſh it.*

CHAP. XIV.

Of the Neck and the Parts contained in it, viz. *the* Larynx, Pharynx, Tonſillæ, *&c.*

The Neck. HAving now diſpatched all the parts of the middle Venter or *Thorax*, we ſhould next proceed to the higheſt, *viz.* the Head; but betwixt theſe two is the Neck ſituated, like an *Iſthmus*, which therefore we muſt take in our way, and deſcribe the parts contained in it.

Its Name. It is called *Collum*, either *à Colendo*, becauſe it uſed to be adorned with Chains, *&c.* or becauſe it riſeth out of the Trunk of the Body *inſtar Collis* like an Hill. *Collum* is a general name for the whole Neck, but the hinder part of it is particularly called *Cervix*.

Parts containing. The parts of it are either *containing*, or *contained*. The *containing* are the ſame which are

found

found in the reſt of the Body, ſaving that the *Membrana carnoſa* ſeemeth to be more fleſhy.

Contained. The Parts *contained* are theſe.

1. Larynx. 1. The *Larynx*, which is the upper part of the Wind-pipe, and the Inſtrument of forming the Voice.

Its Figure. It is almoſt round and circular in *Figure*, onely jetting out a little before, and ſomething flattiſh behind, to give way to the Gullet in ſwallowing.

Bigneſs. Its *Bigneſs* differs according to Age, Sex, and Temperament, whence proceeds the great diverſity of Voices. Such in whom it is narrow, as in younger People, have ſhrill and ſmall Voices; ſuch as have it wide and are come to Maturity, have fuller and more hoarſe. The Voice is altered alſo in reſpect of the length or ſhortneſs of the *Larynx*, and as the Air is more ſtrongly or weakly expelled.

Veſſels. It has *Arteries* from the *Carotides*, *Veins* from the external Jugulars, and *Nerves* from the recurring Branches of *par vagum*.

Subſtance. Beſides the Membranes which are common to it with the reſt of the *Trachea* (deſcribed before, Chap. 12.) it is made up of five Cartilages and thirteen Muſcles.

Cartilages. The *firſt* Cartilage is called θυρεοειδὴς, *ſcutiformis*, or *Buckler-like*; for within it is hollow, but without imboſſed or convex: that part which ſticketh out is called *pomum Adami*, from an idle Fable, That part of the fatal Apple by God's judgment ſtuck in his Throat, and that this Cartilage being thereby diſtended was made to jet out, and the protuberance propagated to Poſterity. It is greater in Men than in Women. In its corners it has four Proceſſes, two longer ones above, whereby it is joined to the lower ſides of the *os hyoides* by the help of a Ligament; and two below, by which it adheres to the cartilage next below it. At the ſides of this cartilage, and the following, are the Glands placed called *thyreoideæ*, which Dr. *Wharton* ſays are of the ſhape of a Pear or Fig, being ſomewhat hollow on that ſide next the *Aſpera Arteria*, and ſomewhat copped on their outer ſide. Their ſubſtance is more ſolid than that of other Glands, and liker to muſcular fleſh, though it be not fibrous. They contribute to the roundneſs of the Neck by filling up the empty ſpaces about the *Larynx*; and the humour ſeparated in them ſeems to ſerve for the lubricating of the *Larynx*, whereby the voice may be made more ſmooth and ſweet.

The *ſecond* Cartilage is called κρικοειδὴς *annularis*, becauſe it is like a Turkiſh *ring*, and compaſſeth the whole *Larynx*; in the hinder part it is broad and thick.

The *third* and *fourth*, becauſe of the Membrane that inveſts them, ſeem but one; but it being removed, they appear to be two. However they have but one name which is ἀρυταινοειδὴς *guttalis*, becauſe when their two proceſſes are joined together, they are *inſtar gutturnii*, like to that part of the neck of a Jug or *Ewer* at which we pour out the water. For by their juncture they frame a *rimula* or little chink (for the modulating of the voice) called *Glottis*.

The *fifth* is called *Epiglottis*, becauſe it is placed above the *Glottis* or Chink, and covereth it. It is of the form of a Tongue, and is appointed to hinder the falling down of any thing which may prove offenſive unto the Windpipe, when we eat or drink. It is preſſed down by the weight of the things which are ſwallowed, for they ſlip over it down into the *Gula*. *Steno* takes notice of little holes or pipes perforating this Cartilage, which, he ſays, ſpring from certain caruncles on its upper ſide, from whence they evacuate an humour on the other ſide looking towards the *Larynx*.

Muſcles. The *Muſcles* by which theſe Cartilages are moved in forming the voice, are thirteen in number; but as for their names and deſcription, the Reader may pleaſe to conſult Book V. Chap. 11.

2. Pharynx. The ſecond part contained in the *Neck* is the upper part of the Gullet, which is called *Pharynx*, from φέρω, becauſe it conveyeth the meat and Drink towards the Stomach. It is continued to the *Fauces*, (or indeed is the greateſt part thereof) reaching up behind to the *Uvula*, on the ſides to the *Tonſillæ*, and before to the *Epiglottis*. It is membranous; but not purely ſo, for it is thick and in ſome ſort carnous. It has ſeven Muſcles, to aſſiſt it in ſwallowing, three pair to open it, and an odd one, which is called its Sphincter, to ſtraiten it; of which afterwards Book V. Chap. 12.

3. Tonſillæ. The next parts are the *Tonſillæ*, commonly called *Almonds*, which are two Glands ſeated at the root of the Tongue, on each ſide of the *Uvula*, and at the top of the *Larynx*, covered with the common Membrane that inveſts all the Mouth. Dr. *Wharton* ſays, that though they ſeem two, yet they are really but one, being continued to one another by a thin and broad production which is of the ſame glandulous ſubſtance with themſelves. He ſays they are of a yellowiſh colour,

lour, and compares their ſubſtance to concreted Honey, onely they are of a more firm conſiſtency, but they look ſandy like it: They have ſmall Veſſels from the Jugular *Veins* and *Arteries*, and *Nerves* from the fifth pair.

Their Duct. They have each a large oval common Duct or *Sinus* that opens into the Mouth, ſo wide in an Oxe that one may put the tip of the little finger into it. Into this many leſſer open, and by it diſcharge into the Mouth, *&c.* the liquor that is ſeparated in the Gland. *Fallopius* hath obſerved this aperture or *Sinus* to look like a ſmall ulcer when the Gland has been ſwelled, and ſometimes by unskilful Perſons to have been treated as ſuch, when it has onely been forced to gape a little too much through the too plentiful defluxion of Humours upon the Gland.

Uſe. The *Uſe* of theſe Glands was by the Ancients ſuppoſed to be only to ſeparate a certain mucous or pituitous matter from the Blood, for the moiſtening and lubricating of the *Larynx*, Tongue, *Fauces* and Gullet: but Dr. *Wharton*, and as many as attribute a fermentative quality to the *Saliva*, aſcribe a more noble uſe to them; *viz.* to make a Ferment to further the concoction of the Stomach: yea, Dr. *Wharton*, (but I think miſtakingly) thinks that they are the chief Inſtrument of Taſte.

4. Glandulæ Jugulares. Beſides theſe there are other *Glands* in the Neck, which from their ſituation Dr. *Wharton* calls *Jugulares*; for they are ſeated by the ſides of the Jugular Veſſels. He ſays he has obſerved them to be fourteen on each, beſides another longiſh one ſeparated from the reſt, lurking on each ſide at the root of the *proceſſus ſtyloides* between the Muſcles of the Neck and Jugular Veſſels. The uppermoſt

moſt are paleſt of colour, and the lower the redder. They grow in knots as it were, and are of an unequal bigneſs, varying from the ſmalneſs of Coriander-ſeed to the bigneſs of a Bean. They have no proper excretory veſſel, and ſo are of the nature of conglobate Glands, which return the *Lympha* by the Lympheducts into the Blood. Among or near unto theſe Glands are commonly, thoſe ſtrumous ſwellings that are ſo frequent in the Neck.

As for thoſe other Glands which are commonly reckoned as Parts contained in the Neck, *viz.* the *Maxillar* and *Parotides*; becauſe their excretory Veſſels diſcharge that liquor that is ſeparated in them into the Mouth, we ſhall defer the deſcription of them to the *Twenty ſixth Chapter* of the *Third Book* which treats *of the inner parts of the Mouth.* Neither ſhall we here mention the Veins and Arteries that paſs through the Neck to the Head, having deſcribed them before, in Chap. 9. and 11.

And as to other Parts that make up the Neck, *viz.* the ſeven *Vertebræ*, and eight Muſcles, thoſe will come to be treated of in their proper Books: And therefore omitting them here, we ſhall paſs on to the *Head.*

The End of the Second Book.

The

The Third Book.

OF THE

HEAD.

CHAP. I.

Of the Head in general, and its common containing Parts.

NOW followeth the third and higheſt *Venter* of the Body, called *Caput*, the Head. This is the moſt noble Cavity of the three, containing the Brain, wherein the rational Soul more eſpecially operates, and whereby all the animal motions of the whole Body are moderated and determined; as well as performed by means of the Spirits elaborated in it, and ſent into all the parts by the Nerves. *The Head.*

It is *ſeated* in the higheſt place of the Body, becauſe it contains the Organs of the Senſes, moſt of *Its Seat.*

of which perform their office more advantageouſly by this ſublime ſituation. For from hence the Eyes can behold things remote, as from a Watch-tower; here the Ears draw in the ſounds that fly aloft; and the Noſtrils receive the aſcending Odours.

Figure. Its *figure* is ſpherical; yet ſomewhat flattiſh, and longiſh.

Bigneſs. It is *bigger* in Man than in other Creatures, conſidering the proportion of their Bodies; as his Brain that is contained in it, alſo is.

Parts. The *parts* are of three ſorts, for they are either 1. diſtinctive, or 2. expreſſive of the regions, or 3. conſtitutive of the whole.

The parts *diſtinctive* are two, the hairy ſcalp called *Calva*, and that without hair called *Facies.*

The parts which *expreſs* the regions (of the firſt,) are four: 1. *Sinciput* or the fore-part, reaching from the Forehead to the coronal ſuture. 2. *Occiput* the Noddle, or hinder-part, beginning at the ſuture *Lambdoïdes*, and reaching to the firſt *vertebra* of the Neck. 3. *Vertex*, the Crown, which is ſituated on the top of the Head between the bounds of the *Sinciput* and *Occiput.* And 4. the lateral parts deſcending from this on each ſide between the Ears and Eyes, called *Tempora*, or the Temples.

The parts *conſtitutive* are either *containing*, or *contained.* The *containing* are either *common* or *proper.* The *common* are thoſe we treated of in Chap. 3. of the Firſt Book. The *Cuticula* is thinner and ſofter; but the Skin thicker than in any other part of the Body, yet porous, that room may be left for the Hair to grow, and for its nouriſhment to paſs to it. The *Membrana carnoſa* in ſome aboundeth ſo with Muſcular Fibres, and cleaveth ſo cloſe to the Skin, that they can move it at their pleaſure.

We ſhall not need to ſay more here of theſe, or of other the *common* containing parts, but refer the Reader to the above-cited place: and now proceed to the *proper*, having firſt diſcourſed a little of the *Hair*.

CHAP. II.

Of the Hair.

The Head. Its name. THE *Hairs* of the *Head* are called in Latin *Capilli*, quaſi *Capitis pili*, and differ not from the Hairs in any other part of the Body, ſave in length.

Definition. Now an *Hair* may be defined to be a *body cold and dry, ſmall, thread-like, hard and flexible, budding from the Skin.*

Figure. The Hairs are ſeldom round, but generally four-ſquare, as the ſtalks of ſome Plants; ſometimes triangular, but always porous, the pores running length-ways. All theſe things may be obſerved by the help of a good Microſcope. They are ſometimes curled, and ſometimes hang lank.

Diviſion. Hairs are commonly divided into *Congeniti*, ſuch as we bring into the World with us, as thoſe of the Head, Eyelids, and Eyebrows; and *Poſtgeniti*, ſuch as begin to grow at certain ſeaſons in our life-time, as the Beard, the Hairs growing about the *Pudenda*, on the Breaſt, in the Armpits, and the like.

Life. They are no parts of the Body, and therefore have no *Animal* life; yet they have a *Vegetative* life, and that peculiar to themſelves, and not owing to the life of the Body, ſeeing they continue to grow after a Man is dead, as has been obſerved in embalmed Bodies. *Diemerbroeck* (and before him *Malpighius*) ingeniouſly compares them to Polypody, or ſome other Plant growing upon an old Tree, which continue to grow after the Tree is dead as they did before, becauſe they have a proper life diſtinct from the form or *anima* of the Tree out of which and in which they grow.

Generation & Nouriſhment.

The matter out of which they are *bred* and *nouriſhed* is commonly reputed to be a moiſt, fuliginous, craſs, earthy and ſomewhat viſcid excrement of the third concoction. *Spigelius* thinks they are nouriſhed by Bloud: which opinion he grounds on an analogy he ſuppoſes there is between Hair, and the Feathers of Fowl; and theſe latter he ſays are apparently nouriſhed by Bloud, for if one pull one from off a young Fowl, its end is bloudy. *Diemerbroeck* diſſents not much herefrom, but thinks the Bloud to be prepared and concocted in a ſpecifical manner into a craſs, earthy and viſcid juice. Whatever the matter of their *nouriſhment* be, it is attracted by the white roots of the Hairs, and is carried even to their very ends by the pores; juſt as Plants receive nouriſhment out of the Earth by their Roots, and communicate it to their outmoſt parts. *Malpighius* ſays, their head or root being round and mucous, is ſet in a kind of Oval-Caſe, (as in a Flower-pot) to which caſe a Nerve is evidently propagated.

Colour.

The *colour* of them differs according to the Climate, or to the natural conſtitution of the party, or to the diverſity of thoſe humours that are mixed with the juice whereby they are nouriſhed. In thoſe of cold flegmatick conſtitutions they uſe to be of a light colour, in cholerick, reddiſh, *&c.* They are moſt commonly ſtreight in thoſe which are born in cold Countries, but curled in thoſe who inhabit hot Climates.

Why Hair turns white.

And as the reaſon of the difference of the colour of the Hair in ſeveral perſons is from different temperaments, *&c.* ſo the reaſon why Men in old Age grow *grey*, whenas their Hair before was of another colour, ſeemeth to be the predominance of flegm in that juice that nouriſheth them: whence alſo the Hairs of the Head and Face ſooneſt turn white, becauſe the Brain does more abound with pituitous humours than any other part of the Body. But it is not ſo eaſie to give a reaſon of ſome Mens turning grey in one nights time, when they have been under great fears; (of which there are many inſtances credibly reported.) Yet *Diemerbroeck* gives a reaſon ſomewhat probable, *viz.* " That in great fear and terrour, the heart by accident is in great anguiſh, " whence it beats little and very weakly, ſo that " ſome from this cauſe fall into a ſwoon: by reaſon of the weak pulſe little blood is impelled into the outer parts, whence by and by they " grow cold and ſtiff: blood failing in the Skin, " the colour alſo in the juice that nouriſheth " the Hair, is by and by changed from that " which before was induc'd upon it from the Humours mingled with the blood: Then if by " chance whitiſh pituitous humours ſtuck before " in the Skin, they will preſently infect the juice " that nouriſheth the Hair with the prevalency " of their own colour, which juice paſſing through

“ the Hair continually even to their end and nouriſhing them, their Colour may from hence “ be changed in a ſhort time, and become white, “ ſeeing their ſubſtance is diaphanous as it were, “ eaſily admitting of any Colour which is communicated to it with the nouriſhment.] See his *Anat. corp. human.* p. 559, 560. where he anſwers ſome Objections that may be made againſt this Opinion.

Their Uſe. The Hairs have three *Uſes*: for they ſerve, 1. for Defence, 2. for Beauty, and 3. ſhew the temperature of the whole Body and Skin.

CHAP. III.

Of the proper containing Parts.

THE *proper containing* Parts are ſix; to wit, the Muſcles, the *Pericranium*, the *Perioſteum*, the *Cranium*, and the two *Meninges*. Look for the *Muſcles* in the *Fifth Book*, and for the *Cranium* in the *Sixth*. Of the other here. And, Firſt,

The Pericranium. The *Pericranium* (which is ſo called from its being extended περὶ τὸ κρανίον *about the Skull*) is a Membrane ſomewhat thin, denſe and white, of exquiſite ſenſe, immediately ſeated under the *Membrana carnoſa*. It covereth the whole Skull, immediately next to the *Perioſteum*, except where the temporal Muſcles lie upon the *Cranium*, for it is ſtretched over *them*; and ſeeing it is very ſenſible and tender, it cauſeth horrible pain and inflammation, when the temporal Muſcle is wounded.

Its Connexion.

It is *knit* to the *Dura Mater* by ſome nervous Fibres, which paſs from it to within the Skull by its ſutures, to ſtay firmly the *Dura Mater*, and alſo the Brain which it inveſts, from violent concuſſion. For though in Infants new-born theſe be ſtrongly united and in a manner continued, inſomuch that the *Pericranium* is ſaid by ſome to ſpring from the *Dura Mater*; yet in proceſs of time they part ſo, as to be knit to one another onely by theſe nervous Fibres, by which yet, inflammations may be communicated from the *Pericranium* to the Brain.

Perioſteum.

Next under the *Pericranium* is ſpread the *Perioſteum*, which immediately cleaveth to the Skull, and gives it that ſenſe which it hath. It ſelf is a very thin and nervous Membrane, and of very acute ſenſe. All the Bones of the whole Body (except the Teeth) are inveſted with ſuch alike Membrane, and owe their ſenſe to it. Some deny it to be found here, affirming that the *Pericranium* ſupplieth its place: But that cannot be ſo, for the *Pericranium* (as was noted above) goeth above the temporal Muſcles, whereas the *Perioſteum* always cleaveth cloſe and immediately to the Bone, as here it doth to the Skull under the ſaid Muſcles.

Their Veſſels.

Theſe two Membranes outwardly inveſting the *Cranium* have *Arteries* from a branch of the external *Carotides*, and *Veins* from the external Jugulars.

The Meninges.

The *Meninges* follow, called by the *Arabians Matres*; as if all the Membranes of the Body were propagated from them. Theſe are immediately within the Skull, as the other were without; but adhere not cloſe thereto, as thoſe do.

They are two in number: the *Craſſa Meninx* or *Dura Mater*, and the *Tenuis Meninx* or *Pia Mater*.

Dura Mater. The *Dura Mater* is the outer, that is, is next to the Skull, through whoſe Sutures ſending Fibres to (or receiving them from) the *Pericranium*, it is ſuſpended thereby; for in other places it is looſe from the *Cranium*, ſaving in its *baſis*, to which it is ſo firmly knit, that it can hardly be pulled from it; or where it is ſuſpended by Veſſels entring into it from the perforations of the Skull; or laſtly where it adheres to the *Os cribriforme* at the top of the Noſe, and ſends jags through its holes. It is thicker and harder than the inner, whence it has the Epithet of *Dura*, hard. It conſiſts of a double Membrane, the outer of which is more rough, towards the *Cranium*; and the inner on its ſuperficies next the *Pia Mater* is more ſmooth and ſlippery, being bedewed with a kind of water. This inſide is looſe, ſaving that near the *Sinus's* it is knit to the *Pia Mater* by the inſertions of the Veins, and in the *Baſis* of the Skull by the Arteries and Nerves.

Its Holes. It has many *foramina* or holes for the tranſit of the Veſſels; and beſides, one very large one in its *Baſis* for the deſcent of the ſpinal Marrow, and another ſmall one which forms the upper orifice of the *Infundibulum*.

Veſſels. It has *Arteries* from the larger branches of the internal *Carotides*, (entring into it through the holes of the wedge-like Bone) and *Veins* from the internal Jugulars. Dr. *Willis* obſerves, That its *outer ſuperficies* has no where ſo many twigs of Veins as of Arteries; but that out of its four *ſinus* (which are the venous receptacles of the Blood)

Blood) more Veins go forth through its *inner ſuperficies*, which being preſently inſerted into the *Pia Mater* are diſperſed all over it, and every where meeting the Arteries aſcending from the *Baſis* of the Head, and being branched with them, make manifold *plexus* of Veſſels.

At the Crown of the Head it is doubled; and its duplicature deſcending inwards, divides the Brain into the right and left ſide: yet its deſcent is not quite to the *Baſis* of the Brain, but onely through the cortical part; for toward the *Baſis* both ſides of the Brain are contiguous to one another, making one continued Body, namely that part of it which is called *Corpus calloſum*, of which in the next *Chapter*. This duplicature, becauſe it is broader backwards, and grows narrower forwards, and ſo reſembles in ſome manner a Reaper's Sickle, is called *Falx*. Now this *Falx* reaches as far forwards as to the top of the Noſe, where it is knit to the upper proceſs of the *Os cribriforme* that ſtands up betwixt the *Proceſſus mammillares*, and is called *Galli criſta* or Cock's Comb. But its hinder and broader part towards the *Occiput* being ſevered, deſcends towards both the right and left ſide, and parts the *Cerebellum* from the *Cerebrum*. Falx.

In the ſaid duplicature are formed four *Sinus* or Cavities, three pretty large, and one little one. The firſt, which is the higheſt and longeſt, runs along the upper part of the *Falx*, from the top of the Noſe lengthways of the Head towards the *Occiput*, where it is divided into two lateral *Sinus* which deſcend by the ſides of the Lambdoidal Suture to the *Baſis* of the *Occiput*. And at the ſaid diviſion the fourth ſhort *Sinus* proceeds inwards from it betwixt the Brain and Sinus.

Cerebel to the *Glandula pinealis.* This place, where all the *Sinus* are continuous to one another, is called *Torcular*, the Wine-preſs.

Their Uſes. Into theſe Cavities the Mouths both of Arteries and Veins are ſaid to open; by the former whereof Blood is extravaſated into them, and abſorbed again out of them by the latter. Whence if one open the Skull of a live-Creature, one may obſerve a beating in the long uppermoſt *Sinus*, from the Blood diſcharged into it by the Arteries. Dr. *Highmore* thinks, that much blood being ſent to the Brain by the *Carotides*, all of which is not fit to have Animal ſpirits elaborated out of it; *that* part of it which is leſs fit and neceſſary for this purpoſe, is diſcharged into theſe *Sinus* to be returned by the Veins; even as a notable branch of the Cœliack Artery (when it is come juſt to the Spleen) is implanted into the *Ramus ſplenicus* of *Vena portæ*, by which that Arterial blood that is unmeet or unneceſſary for the making of that juice (whatſoever it be) which is excocted in the Spleen, may be remanded back again. And ſome are of opinion that the Veins alſo convey ſome blood into theſe *Sinus*, which being ſuperfluous to the nouriſhment of the *Brain* and *Meninges*, is poured in hither by the Veins from the reſpective parts, and is imbibed again by other Veins whoſe mouths gape into them, (namely the branches of the internal Jugulars) to be returned to the Heart.

Pia Mater. The ſecond (and inner) Membrane inveſting the *Brain* is called *Tenuis Meninx* or *Pia Mater*. This is of moſt exquiſite ſenſe, and endowed with very many Arteries and Veins. It immediately cloaths the *Brain*, and hinders it from running about, and alſo involves all its windings and circuits,

cuits, and tying their ſummities together makes all the ſuperficies of the Brain plain as it were: which upper connexion being looſed, the windings of the Brain, being all inveſted apart with this Membrane, may eaſily be ſeparated and laid open. But it is onely the Cortical part of the Brain which this Membrane cloaths thus; for the inner ſurface of the expanded Brain (which is called *Corpus calloſum*) is not inveſted by it; but inſtead of it (Dr. *Willis* ſays) "Many "*plexus* of Veſſels, commonly called *Choroïdes*, "are ſuſpended within its complicature, and "fluctuate as it were freely. But within all the "other receſſes of the *Brain*, and beſides, within "the *Plicæ* or *Lamellæ* of the Cerebel, yea, with- "in the interſtices of each of them and of the "*Medulla oblongata*, does this Membrane inſinu- "ate it-ſelf.]

Its Veſſels and their Plexus.

This Membrane is interwoven with many admirable *Plexus* of Blood-veſſels, both Arteries and Veins. The *Arteries* are four, *viz.* two *Carotides* and two *Vertebrals*. The *Vertebral* Arteries being united at the *Baſis* of the Skull, and making a ſingle trunk, it meets and joins with the *hinder branches* of the *Carotides*; and from the place of their coalition a very remarkable branch aſcends on either ſide under the *limbus* of the Brain, which being carried above the *crura* of the *Medulla oblongata* is divided into very many ſlender and as it were capillary twigs, ſome of which aſcend to the Glands ſeated behind the Cerebel, and the reſt make the Arterial Part of the *Plexus Choroïdes*. The *fore* branches of the *Carotides* do alſo unite one with the other; and both before and after their joining ſend forth twigs all over this Membrane, but chiefly in the fore-part of the Brain. Its *Veins* ariſe from the four *Sinus* of the *Dura Mater*, (as was obſerved above from Dr. *Willis*) and theſe meeting with one another are diverſly interwoven one with another and with the Arteries, and return the ſuperfluous Blood by the Jugular Veins to the Heart.

Note, That both the ſpinal Marrow (extended to the bottom of *Os ſacrum*) and all the Nerves that ariſe out of it, and out of the Brain, have a double Coat from theſe two *Meninges*, with which being cloathed they run to their deſigned Parts.

CHAP. IV.

Of the Brain in general.

The Brain. THE *Pia Mater* being taken away, the *Brain* occurs next; by which here we mean in the general, all that ſoft ſubſtance which is contained within the whole Skull, and which the Greeks comprehend under the word ἐγκέφαλος. It is the general Organ of ſenſe, *in* which the Soul, the Governour of the Body, perceives and judgeth of the Senſations of all ſentient Parts; and *out of* which, as out of a Fountain, it communicateth the Animal Spirits (bred in the Brain) by the Ducts or Rivulets of the Nerves to all the ſentient parts of the Body, and thereby endows them with the Faculty of performing Animal Actions.

The difficulty of diſſecting it. The *Brain* being of ſo looſe a Subſtance, and the Skull wherein it is incloſed, ſo hard, that the Saw or Chizzel are neceſſary to break through it, the Brain muſt needs be very much ſhatter'd and concuſſed thereby; and after the Skull is divided, in the very pulling of it off, the vaſcular connexion of the *Dura Mater* and it with the *Pia Mater* and *Brain*, (and that alſo of the one with the other) being torn in ſunder, the parts into which the Veſſels are inſerted, are neceſſarily much violated: and laſtly, after the covers are removed, ſeveral parts of the Brain being of ſuch difficult acceſs, that others muſt be quite ſpoiled, before one can come to a view of them, and theſe alſo thereby in part violated: Upon all theſe accounts a true Anatomy of the Brain, as to its Contiguities, Connexions, Cavities or Ventricles, *&c.* muſt be very difficult; ſo that 'tis no wonder the obſervations of Anatomiſts are ſo different, and ſo oppoſite to one another. But this by the bye. Paſs we on now to diſcourſe of the *Brain* more generally.

Its Subſtance.

If by *Brain* we underſtand the whole *Encephalos*, (or all that which is contained within the Skull) it is not of one *Subſtance*, but divers: for the ſeveral parts of it are of a different Subſtance. The outſide of the Brain (*properly* ſo called) is of an Aſh-colour, and is termed *Cortex*, being as it were the *Bark* to the inſide or *Pith*, which is white. This *Cortex Malpighius* teaches to be glandulous. "The outſide of theſe Glands "(ſays he) is covered with the *Pia Mater* and its "Blood-veſſels, which penetrate deep into their "Subſtance; (each Gland having a twig of both "an Artery and a Vein) their inner ſide ſends "forth a white nervous Fibre, like a proper Veſ"ſel as it were, ſo far as their brightneſs and "whiteneſs permit one to diſcover. Theſe Fi"bres make up all the *Pith* (or *Corpus calloſum*) "which is of a more cloſe and ſolid Subſtance

" than the *Cortex*. They are flattiſhly round, " and are not unlike thoſe white Bodies, or " *Inteſtinula*, which the Teſticles are made up " of; and in the Ventricles of the Brains of Fiſh " they are ſo apparent, that if you hold them be- " twixt you and the light, they repreſent the " ſmall teeth of an Ivory Comb. He ſaith they " are inſerted by their ends into (or rather ariſe " out of) the *Cortex* or aſh-coloured outer Part " of the Brain, and ſeem all of them to have " their egreſs out of (or rather ingreſs into) the " trunk of the ſpinal Marrow within the Skull.] Whether they be hollow or not, or whether as they are collected into a bundle they have not Pores and Interſtices ariſing therefrom, which tranſmit a peculiar juice into the Nerves continued to them, he leaves undetermined; becauſe they neither admit of ligature, nor can ſenſe make any diſcovery thereof. As for the other parts of the *Encephalos*, viz. the Cerebel and *Medulla oblongata*, their *Subſtance* ſhall be treated of afterwards, when we come to their Deſcription.

Veſſels. The *Brain* receives Blood by *Arteries* derived from the *Carotides* and Cervical, whoſe Capillaries are diſperſed chiefly through its cortical part. Theſe Arteries are ſo large and numerous, that a third part at leaſt of the whole Maſs of Blood is conveyed hither by them; which ſeeing through the ſmallneſs of the Brain it cannot be conſumed in its Nutrition, *Malpighius* thinks it probable that the coagulative (or concreſcible) *Serum* is filtred as it were in the *Cortex* (or glandulous part) of the Brain from the Arterial Blood, and that the Fibres of the *Corpus Calloſum* as ſo many roots implanted into the ſaid *Cortex* imbibe

imbibe this *Serum* and convey it to the *Medulla oblongata* as the trunk from whence it is derived, into the Nerves as the branches, and is there the *Succus Nervoſus*, if not the Animal Spirit it ſelf. Part nouriſhes the Brain it ſelf, and what is ſuperfluous to both theſe Uſes, is partly reſumed by the *Veins* of the *Meninges* (whoſe twigs reach to the ſeveral Glands of the *Cortex*) and partly depoſited in the *Sinus's* of the *Dura Mater* by the Arteries themſelves, out of which it is reſorbed by the internal branches of the Jugulars, and thereby conveyed back to the Heart. The Arteries inoſculate one with another (*i.e.* the right *Carotides* with the left) and ſo do the Veins alſo; but not the Arteries with the Veins. It is from the Pulſe of the Arteries altogether, that the beating (or *Syſtole* and *Diaſtole* as it were) of the Brain proceedeth.

A Man of all other living Creatures hath the *biggeſt Brain*; for it weigheth four or five pound in ſome; and is as big again as an Oxe's Brain. *Bigneſs.*

The outer ſurface is full of Windings, like thoſe of the Guts, which are ſeverally inveſted with the *Pia Mater*, as alſo tied together by it. The whole Brain is much of the ſame *Shape* with the Head, *viz.* roundiſh, but with bunchings out towards the Forehead. *Figure.*

Of its *Action* we ſhall ſpeak in the Ninth Chapter.

CHAP.

CHAP. V.

Of the manner of diſſecting the Brain: of the Brain properly ſo called, the Fornix, Septum, *and the three Ventricles.*

THere are ſeveral methods of diſſecting the Brain; ſome beginning at the Crown, which was the old way; ſome on the right ſide, as *Sylvius*; and ſome behind, as Dr. *Willis*: whoſe Anatomy of the Brain being much more accurate than that of any before him, we will endeavour to give a ſhort but faithful abſtract of it.

The manner of diſſecting the Brain.

Having taken out of the Skull the whole *Encephalos*, or all that which is contained under the name *Brain* taken in a large ſenſe, firſt of all let the hinder *limbus* or bordure of the Brain properly ſo called, where it is knit to the *Cerebellum* and *Medulla oblongata*, be freed as clear as may be from its coheſion with the ſubjacent parts, cutting aſunder the veſſels and the membranes on every hand, for by theſe onely is it joined to them. Its hinder part being thus looſened, lift it up and turn it forwards, whereby the *Crura* of the *Medulla oblongata* will lie bare, and the *three Ventricles* of the Brain, commonly ſo called, will become *one empty ſpace*, as being a vacuity reſulting merely from the complication of the Brain. Moreover one may then ſee, how the two tips of the *Crura* of the *Medulla oblongata* are knit in two places to the *Corpus calloſum* or medullar part of the Brain; as alſo obſerve the

Fornix ſo called, how it is like a *ſubtenſa*, or line drawn under the arch of a circle, which beginning before, where the aforeſaid tips of the *Crura* adhere to the Brain, runs to the Brain's hinder bordure, to which it is united by two ſtretched out arms as it were, and ſo keeps the whole *compages* of the Brain in a ſpherical figure, hindring it from ſpreading into a plane, and ties it firmly to the *Crura* of the *Medulla oblongata.*

This is Dr. *Willis*'s manner of diſſection, wherein the parts occurr to the Diſſectors inſpection in this order.

The Brain properly ſo called.

Firſt the *Brain* it ſelf, whoſe outer ſurface is all full of windings, like the convolutions of the Guts: It is divided by the *Falx* (above-deſcribed) into two hemiſpheres, a right and left; and theſe are ſubdivided each into two Lobes, a fore and an hinder, by a large branch of the Carotid Artery running croſs the middle of them. How deep the *Falx* enters into the Brain, and of what ſubſtance the Brain is, has been ſhewn in the former Chapters: We ſhall only further note here concerning its ſubſtance, that its medullar part (or *Corpus calloſum*) is both thicker and cloſer by much in the fore parts of each hemiſphere than any where elſe; and that where it is thickeſt, it adheres on each ſide to the tips of the *Crura* of the *Medulla oblongata* (called *corpora ſtriata*:) but from theſe tips, as from its riſe, being expanded towards the hinder parts, it grows thinner by degrees, and towards its outer bordure its under ſide is knit to the *Caudex* or trunk of the *Medulla oblongata* by membranes and veſſels.

Fornix.

Which membranes and veſſels being cut in ſunder, and the Brain turned up forwards as above-directed, on its inner or under *ſuperficies* there appears a medullar Proceſs called *Fornix*, which ſpringing forth of the *Corpus calloſum* with a double root, is united into one broad Proceſs near the place where the tips of the *Crura* of the *Medulla oblongata* adhere to the under-ſide or medullar part of the Brain, and ſerves as a *Subtenſa* to its Arch, (as was noted before.) Under the double root of the *Fornix* there lies a medullar Trunk, like a large Nerve, running croſs the Brain and joyning one *Corpus ſtriatum* to the other. And out of the middle ſuperficies of the *Fornix* there ſtands up a thin and pellucid *Septum* or Partition, which is faſten'd to the roof or arch of the *Corpus calloſum* almoſt through its whole Duct.

Septum.

This *Septum Columbus* affirms to be membranous, and *Malpighius* will have it to conſiſt of ſtreight Fibres running lengthways from before backwards. And thus while the three-ſided *Fornix* doth ſubtend the Arch that ariſes from the complication of the Brain, it divides its Cavity as it were into *three Partitions*, and makes them look like ſo many *Ventricles*, by which name they have been deſcribed by former Anatomiſts.

Three Ventricles.

To theſe three *Ventricles* thus accidentally formed, the Ancients have attributed a noble Uſe; determining them to be the Work-houſe of the Animal Spirits, where they are both generated, and perform the chief works of the Animal Function. *Fracaſſatus* (who calls the Brain a Wind-Inſtrument, ſomewhat analogous to the Lungs) thinks that a purer ſort of Air aſcends through the *Os cribriforme* into the two fore Ventricles, (where it is ethereized) and paſſes out of them into the third, and thence into the fourth (to be deſcribed in Chap. 7.) by which it is conveyed into the ſpinal Marrow, where being mixed with the nervous juice, it therewith conſtitutes the Animal Spirit, and likewiſe promotes its motion. Where, and whereof the Animal Spirits are generated, we ſhall conſider, Chap. 9. and ſhall here ſhew a more probable Uſe of theſe Ventricles. They have been commonly diſtinguiſhed into *two anterior*, and *one poſterior*. But the truth is, there is but one Cavity or *Vacuum*, and inſtead of that noble Uſe heretofore aſcribed to it, late Anatomiſts make it only as a ſink or common-ſhore for excrementitious matter to be collected in, and to be diſcharged out of again by convenient ways. This excrementitious matter is generally a ſerous humour which is ſeparated from the Blood in the adjacent *Plexus Choroides* by the help of thoſe many Glands that that *Plexus* is beſet withal, and of the *Glandula pinealis* which the *Plexus* hangs upon and is woven about like a button. As to the exit of this ſerous humour, formerly it has been ſuppoſed to flow from hence to the *Proceſſus mammillares*, and from them to deſtill through the *Os cribriforme* into the Noſe. But Dr. *Lower* denies any ſuch office of the *Os cribriforme*, affirming that the holes in it are only for the tranſit of the Nerves and Membranes going forth from the *Proceſſus*, and that theſe fill them ſo cloſe that nothing can flow through them. And ſays, That the flux of Rheum through the Noſe, and upon the *Uvula*, or into the Mouth, *&c.* in Catarrhs, falls not from the Head, but is ſeparated from the Arteries in the Glands of the reſpective parts, as into the Noſe through the Glands of its inveſting Membrane, *&c.* And as to the ſerous matter that is infuſed into theſe *Si-*

nus in the Brain, he ſays, it is all abſorbed again by the Veſſels gaping into them, and returns by the Jugular Veins to the Heart.

CHAP. VI.

Of the Medulla oblongata *and its* fore *parts, viz.* Crura, Corpora ſtriata, Nervorum opticorum thalami, Nates *and* Teſtes; *as alſo of the* Glandula pinealis, Plexus choroides, *and* Infundibulum.

THE *Brain* continuing turned up forwards, as above-directed, the *Medulla oblongata* lies open to view, whoſe Parts, *&c.* we ſhall deſcribe in this Chapter.

The Riſe of the Medulla oblongata.

The *Medulla oblongata* ſeems to ariſe from the *Corpus calloſum* by two Heads reſembling the letter Y, and the united Trunk by and by deſcends out of the Skull down the Spine, wherein it is called the *ſpinal Marrow*, of which afterwards. *Fracaſſatus* queſtions whether the Brain, and the Cerebell alſo be not rather appendices of, or propagated from the *Medulla ſpinalis* and *oblongata*, than theſe from thoſe; ſeeing in the *Embryo* or firſt lineaments of a Chicken in the Egg, if you prick the *Carina* (or long thread that afterwards becomes the back) with a pin, it will contract it ſelf, whilſt in the Seat of the Brain there is nothing but a *Lympha* not yet fixed into a Brain. But this by the bye.

Its Subſtance.

The *Subſtance* of the *Medulla oblongata* is not like that of the *Brain*, conſiſting of an outward or cortical part of an aſhy colour, and of an inner medullar and white; but its whole *compages* is medullar; yet it is not pure and ſhining, but dusky from its many Fibres that hold a various courſe; for in ſome parts they are ſtriated or radious as it were; in others direct, running lengthways, and in others circular.

Crura *and* Corpora ſtriata.

Its two heads or beginnings are called its *Crura*, and the tips or extremities of theſe *Crura* are called *Prominentiæ lentiformes*, or otherwiſe *Corpora ſtriata*, from the courſe that their Fibres keep. Their ends are blunt, and by a pretty large ſpace of their ſurface adhere to the medullar ſubſtance of the Brain where it is thickeſt. If one cut them in ſunder lengthways, then may he obſerve their *ſtriæ*, which have a double tendency; for ſome deſcend from their tip towards the *Medulla oblongata*, and others ſeem to aſcend from their lower part towards the medullar part of the Brain, the one meeting the other. So that by the help of theſe Fibres there ſeems to be a free paſſage for the Animal Spirits from the Brain to the *Medulla oblongata*, or back again, as there is occaſion. We obſerved above in the former *Chapter*, how there is a medullar proceſs that running a-croſs joins one *Corpus ſtriatum* to the other; and ſhall onely note here further, That juſt behind the lower end of theſe Bodies the *Proceſſus mammillares* or ſmelling Nerves have their riſe from the *Medulla oblongata*.

Thalami nervorum opticorum.

When theſe Nerves are ariſen out of it, its *Crura* riſe into uneven protuberances, out of which ſpring the Optick Nerves, and therefore theſe protuberances are called *Nervorum opticorum Thalami*: (what courſe both the Olfactory and Optick Nerves hold towards the Noſe and Eyes, ſhall be ſhewn in *Ch.* 10.)

Behind theſe *Thalami* the two *Crura* of the *medulla oblongata* unite into one trunk, upon whoſe upper ſide there grow four more notable protuberances, covering its ſurface for about the ſpace of an inch, which yet they do not touch in the middle, having a cavity under them. There grow two on each ſide, the two formore of which are called *Nates*, and the two hinder *Teſtes*.

Nates *and* Teſtes.

The *Nates* (or Buttocks) are the larger of the two, and the *Teſtes* ſeem onely to be an *Epiphyſis* or accretion to theſe. They are all four like ſo many round hillocks, and are joined one to another by certain proceſſes. Under them, or rather betwixt their junctures and the trunk of the *Medulla oblongata* that lies there-under, there is left a narrow but long cavity, which is called the *Fourth Ventricle* by ſome Anatomiſts, but by other later that cavity is placed under the Cerebel, as ſhall be ſhewn in the next Chapter, and the *hinder* end of this opens into it. There is alſo a paſſage from this ſtrait Duct down into the *Infundibulum*. As to the Uſes of the *Nates* and *Teſtes*, the learned Reader may do well to conſult Dr. *Willis* largely diſcourſing thereof, *in Cerebr. Anat.* p. 93, *&c.* but I ſhall not enter upon that Diſpute as being too conjectural and doubtfull.

Glandula pinealis.

Betwixt the *Nates* and the *Thalami Nervorum opticorum*, in a valley as it were, is ſeated a Glandule, called in Greek κωνάριον, in Latin *Pinealis*, from its ſhape, ariſing from a broad Baſis to a narrower copped top, ſomewhat reſembling a Pine-apple. It is faſten'd to the ſubjacent part, ſometimes by many ſlender Fibres, and ſometimes by two notable medullar Roots. Its Subſtance is harder than that of the Brain, and of a pale colour. It is included in a Membrane (which is a portion of the *Pia Mater*) as in a bag or caſe: which Membrane being full of Arteries and Veins, ſome of theſe enter into the Gland it ſelf. This Gland *Des Cartes* thinks to be the primary ſeat of the Soul, and that all Animal Operations draw their Origine from it: But that ſeems to be too noble an Uſe for it; and it is more likely that it is onely of the nature of other Glands which are ſeated near the concourſe of ſanguiferous Veſſels, namely that it may receive into it ſerous humours depoſited from the Arterial Blood, and retain them till either the Veins becoming more empty reſorb them, or Lympheducts (where there are any) convey them away.

Plexus choroides.

That this is the true uſe of the *Glandula pinealis* is the more probable, from that notable *plexus* of Blood-veſſels that encompaſſes it, and hangs upon it as it were, called *plexus Choroides*, which is conſtituted after this manner. From each ſide of the *medulla oblongata*, where the *limbus* of the Brain is knit to it, there aſcend in a ſtreight courſe two Arteries ariſing from the hinder branches of the *Carotides* where they are joined to the Vertebral, which being by and by divided into very many ſmall twigs, and being met by as many twigs of Veins coming from the fourth Ventricle of the *Dura Mater* (which deſcends upon the *glandula pinealis*) form this *plexus*, wherein both ſorts of Veſſels are very much interwoven one with another, and which ſpreads it ſelf on each hand, (as by two expanded wings) upon the *crura* of the *medulla oblongata* as far as to the *corpora ſtriata*: yet theſe Veſſels run almoſt onely upon the ſurface

face of the *medulla*, making no deep inſertions either into it, or into the *corpus calloſum* under which they are alſo ſpread. This *Plexus* is beſet with very many ſmall glands, which are all of them red, and almoſt ſpherical, only a little flattiſh.

Its Uſe. According to Dr. *Willis*, it has a double uſe: *firſt*, he ſays, that the more watery part of the Blood deſigned for the Brain, is ſent into the veſſels of this *Plexus*, that the remainder may be more ſincere and defecate for the making of Animal Spirits: which watry part, if it be ſo plentiful that it cannot be all received into the Veins, to be returned to the Heart, it is then received into the ſmaller glands wherewith the *Plexus* is beſet, but eſpecially by the *glandula pinealis* juſt now deſcribed, by which it is either retained; or if it abound, may deſtil from them into the ſubjacent cavity, as into a ſink. A *ſecond* office is, to preſerve within the plicature of the Brain (or in the *corpus calloſum*) an heat, which is raiſed from the Blood (as from a fire) that eſtuates in the complications of the veſſels of the *Plexus*, and which cauſes the Animal Spirits to circulate in the *corpus calloſum*.

Infundibulum. Thus far as to the parts which appear on the *upper ſide* of the *medulla oblongata*, betwixt the *corpora ſtriata* and cerebel. But within this ſpace in the *baſis* of the ſame *medulla* there are other things obſervable, eſpecially the ſituation and ſtructure of the *Infundibulum*. Now this *Infundibulum* is a tube-like receptacle, outwardly covered with a thin membrane ariſing from the *Pia Mater*, and within fenced with a medullar ſubſtance, which deſcends behind the coalition of the two Optick Nerves, betwixt the *crura* of the *medulla oblongata*: Its upper orifice is between the *crura*, and from thence a ſhort tube or pipe deſcends upon the *glandula pituitaria*, (to be deſcribed in the next Chapter) upon which ſerous humours flow down from the upper cavities of the Brain this way; whence it has its name of *Infundibulum* or Tunnel.

And thus we have done with the *fore* part of the *Medulla oblongata*, which only lies bare by the turning up of the Brain properly ſo called: In the next Chapter we ſhall examine its *binder* part, which comes to our view by raiſing up the *Cerebel*; but of the Cerebel it ſelf firſt.

CHAP. VII.

Of the Cerebellum, *and the fourth Ventricle; as alſo of the* hinder *part of the* Medulla oblongata, *of the* Rete mirabile *and* Glandula pituitaria.

Before we can take a view of the *binder* part of the *medulla oblongata*, it is neceſſary to remove the *Cerebellum* that is placed upon it, (as the Brain is upon the *fore* part) which therefore we ſhall firſt of all deſcribe.

The Cerebellum, *its figure and ſubſtance.*

The *Cerebellum* is ſeated in the hinder part of the Head, being of ſomewhat a globous *figure* as well as the Brain it ſelf, and uneven in its ſurface (like it) by reaſon of certain convolutions, both the ridges and furrows whereof the *Pia Mater* is ſpread over, tying their ſummities together, covering their deep furrows, and reaching *Plexus* of veſſels to them all. But its convolutions are not ſo various and uncertain as thoſe of the Brain, but are diſpoſed in a certain order like ſo many ſemi-circles; the *lamellæ* or plates lying upon and environing it in a parallel courſe. All theſe *lamellæ* have a cortical part and a medullar, which ſeem to be of like ſubſtance with the *cortex* and *corpus calloſum* of the Brain, deſcribed before, Chap. 4.

Its Proceſſus vermiformes. Both regions of the *Cerebellum*, *viz.* the *fore* and *hinder*, terminate in a *worm-like proceſs*, towards which the *lamellæ* or circles are ſhorteſt, lengthning by degrees towards the middle or top.

Veſſels and Glands. The *Cerebellum* has a great many *plexus* of veſſels beſet with Glands, like the *plexus choroides* of the Brain, which come into ſight by ſeparating the *Pia Mater* from its hinder part; for there the *plexus* creep up on each ſide by the worm-like proceſs, conſiſting on each ſide of a branch from the vertebral artery and of venous ducts ſent out of each lateral *ſinus* of the *Dura Mater*. To theſe *Plexus* and Glands Dr. *Willis* aſcribes the ſame uſe as to thoſe of the Brain, *viz.* that the Glands ſerve to ſeparate the ſuperfluous phlegm from the arterial Blood, and to retain it; and that both the Arteries and Veins not only running on the ſurface of the Cerebel, but ſending twigs into its inner ſubſtance, the moſt ſubtile and ſpirituous part of the Blood being conveyed through long windings and ſerpentine ducts of veſſels, and ſo ſublimed into Spirit, is received and retained within, whilſt the more impure and feculent part is ſent back by the twigs of Veins that are alſo deeply inſerted into the Cerebel.

Pedunculi. It reſts upon the trunk of the *medulla oblongata*, or rather ſeems to ſtand upon each ſide of it by two *feet* or *ſtalks*, betwixt which feet on the ſides, the *cerebellum* above, and the *medulla oblongata*

longata underneath, there is formed a cavity which is commonly called the *fourth Ventricle*, of which by and by.

Their Proceſſes.

In each of theſe feet that ſuſtain the Cerebel, there are *three* diſtinct medullar *proceſſes*; the firſt of which proceeding from the *Nates*, aſcends obliquely; the ſecond deſcending ſtreight from the Cerebel, and paſſing acroſs the former, encompaſſes the *medulla oblongata*; and the third deſcending from the hinder region of the Cerebel, is inſerted into the *medulla oblongata*, encreaſing the thickneſs of its trunk.

The annular protuberance.

The ſecond of theſe Proceſſes, *viz.* that which deſcends ſtreight, is it which makes the *annular protuberance* upon the *medulla oblongata*, which it forms in this manner. Deſcending ſtreight upon the *medulla*, aſſoon as it touches its ſides, it ſeems not to be preſently implanted into them, but growing into a greater bulk, encompaſſes the ſurface of the ſaid *medulla* with divers circular Fibres. So that the Fibres of the Proceſs of one ſide meeting thoſe of the Proceſs of the other ſide underneath, or at the *baſis* of the *medulla*, make this circular protuberance. Which that it may be ſeen, as alſo the three Proceſſes of each foot of the *Cerebellum*, *&c.* 'tis neceſſary to cut the Cerebel through the middle, from one Worm-like Proceſs to the other, for then they will all appear plainly.

The office of the Cerebel.

The *office* of the Cerebel has generally been reputed to be the ſame with that of the Brain, *viz.* to elaborate the Animal Spirits, which Anatomiſts have not uſed to diſtinguiſh into different kinds, till of late Dr. *Willis* has taught that ſome Spirits aſſiſt *natural* motion, and others *ſpontaneous*. Accordingly he makes two Laboratories of theſe

Spirits, appointing the Brain for the confection of ſuch Spirits as flow into thoſe Nerves that perform *ſpontaneous* motions, *viz.* ſuch which we are conſcious of, and can moderate or determine, as the moving of the Hand, *&c.* and the Cerebel for the making of ſuch as flow into thoſe Nerves by which *involuntary* or natural motions are performed, *viz.* ſuch as are done in a conſtant manner without our knowledge or will, as the pulſe of the Heart, *&c.* To which opinion of his ſome have made theſe objections: *Firſt*, That Fowl have no Cerebel, and yet their Heart, *&c.* moves. *Secondly*, The motion of the Heart, called natural, depending (in a great meaſure) on the influx of the Animal Spirits conveyed by the *par vagum* which ariſe out of the *medulla oblongata*, one cannot eaſily conceive how the Animal Spirits ſhould flow into theſe Nerves from the Cerebel, and not as well thoſe generated in the Brain; or if they entred them alone, why, *Thirdly*, not only the natural motion of the Heart ſhould be performed by the ſaid pair of Nerves, but voluntary motions alſo, as thoſe of the *Larynx*, *&c.* He that would be ſatisfied of the grounds of Dr. *Willis*'s Opinion, may conſult his *Cerebr. Anat. capp.* 15, 16, 17.

The fourth Ventricle.

We ſaid a little above, that betwixt the two feet of the Cerebel ſtanding on each ſide, and the Cerebel it ſelf above, and the trunk of the *medulla oblongata* below, the *fourth Ventricle* was formed, which we need not further deſcribe, only ſpeak a word of its *uſe*; which ſome have thought to be, for the *perfecting* of the Animal Spirits (as they were *prepared* by the three other) and therefore they have called this *the noble Ventricle.* But as was ſaid above of the other three, that they ſeemed not to be deſigned purpoſely by Nature, but reſulted only accidentally from the conformation of the circumjacent parts, and ſerved only as Sinks to receive ſerous humours ſeparated in the Glands: ſo we believe that this reſults in like manner, and is of the ſame vile uſe.

The hinder part of Medulla oblongata.

Having now removed the Cerebel from off the trunk of the *Medulla oblongata*, we come to have a view of the *hinder* part of the *Medulla*. Now, omitting to ſpeak of the *vertebral arteries* that run up by its ſides, (as having mention'd them often before) as alſo of the pairs of *Nerves* that ariſe out of it (which we ſhall deſcribe afterwards) I ſhall only in this place take notice of the *two* medullar *pyramidal Bodies* adhering to its ſides. These proceed from the *annular protuberance* formed about the *Medulla* by the ſecond Proceſſes of the feet of the Cerebel, near the *baſis* of the *medulla*, and being diſtinct from the reſt of the medullar trunk, they tend ſtreight towards the ſpinal Marrow, and in their progreſs by little and little becoming narrower, after about the ſpace of an inch, they end into ſharp points pyramidal-wiſe, whence they have their name. Dr. *Willis* thinks them to be ducts or chanels of the Animal Spirits from the annular protuberance, or, which is all one, from the Cerebel, to the Nerves that ſpring out of the *Medulla oblongata*, there whereabout theſe pyramidal bodies end.

Corpora pyramidalia.

We have now done with all the parts of the *Encephalos*, whether relating to the Brain, *Medulla oblongata*, or Cerebel, from whence we might proceed to the *action* of the Brain; but we will firſt deſcribe the *Glandula pituitaria* ſeated in the cavity of the wedge-like Bone, with the notable *Plexus* of veſſels ſpread about it in ſome creatures, called *Rete mirabile*; and in the next chapter treat ſhortly of the *ſpinal marrow*, as being an *appendix* or continuation of the *Medulla oblongata*.

Glandula pituitaria. This *Glandula pituitaria* has a proper ſeat of its own made for it in the middle of the wedge-like Bone, in a cavity commonly called *Sella equina*. It is not ſo big in Men, as in many other Creatures, being hardly bigger than a large Peaſe. Its ſubſtance is harder and more compact than that of other Glands. In its circumference 'tis almoſt four-ſquare, above ſomewhat hollow, and below convex. It is covered with a very thin Membrane from the *Pia Mater*, proceeding from the *Infundibulum*, and by means of this Membrane it is knit very cloſely to the *Sella*.

Its Uſe. It has been heretofore a current opinion, that on this gland is poured by the *Infundibulum* that ſerous humour that is collected in the Ventricles of the Brain above; and that from this Gland it deſtils through the holes of the wedge-like Bone upon the Palate, ſo to be ſpit out by the Mouth. But Dr. *Lower* denies this, appealing to the ſtructure of the parts, and his often experiments upon Calves Heads: "In which, he ſays, the wedge-"like Bone lying under the *Glandula pituitaria*, is "ſometimes perforated in divers places, at leaſt "by one large duct, which being divided into "two, does on each ſide open into the Jugular "Veins: ſo that if Milk or Ink be injected thro' "thoſe ducts by a Syringe, it preſently paſſeth "through on each ſide into the ſaid Veins; and "nothing of Tincture will appear about the Pa-"late, Noſtrils, Mouth, *Fauces* or *Larynx*. So "that in a Calf the Humour that proceeds from "the Brain, returns all again into the Veins. "And the ſame thing he ſays he has lately tryed

" in a Man's Skull, wherein though the wedge-" like Bone be never perforated, yet Nature has " framed other ducts, whereby all the *Serum* may " be again derived out of the Ventricles of the " Brain into the Blood: for there are two Veſ-" ſels ſeated on each ſide the *Sella Turcica* (to be " deſcribed Book VI. Chap. 6.) which with gaping " Mouths as it were receive all the Water diſtil-" led out of the *Glandula pituitaria*, and depoſite " it on each ſide into the Jugular Veins without " the Skull; whoſe ducts will eaſily appear, if " Water or Milk be ſquirted forcibly out of a " Syringe into either Jugular Vein near the Skull, " for the liquor will by and by break out near the " *Glandula pituitaria*; which makes it evident, " that whatever *Serum* is ſeparated into the Ven-" tricles of the Brain, and iſſues out of them thro' " the *Infundibulum*, diſtils not upon the Palate, " but is poured again into the Blood, and mixed " with it.] So that according to this opinion, the Rheum that iſſues ſo plentifully ſometimes into the Mouth and *Fauces*, &c. falls not from the Brain, but, as was noted above, is ſeparated from the Arteries immediately by the Glands of the reſpective parts.

Rete mirabile.

In thoſe creatures that have the *Glandula pituitaria* large (as in Calves, for inſtance) the two Carotid Arteries meeting about the *Sella* of the wedge-like Bone preſently divide themſelves into ſmall twigs, which being interwoven with like (though not ſo numerous) twigs from the internal Jugular Veins, and alſo with nervous Fibres from the larger trunk of the fifth pair of Nerves, make on each ſide a notable *Plexus*, called *Rete mirabile*. There enter into this *Rete* ſome twigs alſo from the Cervical Arteries; and there paſs out of it ſeveral twigs into the *Glandula pituitaria.* So that in theſe Creatures that Gland ſeems to be of the ſame uſe to the *Rete mirabile*, as the *Glandula pinealis* is to the *Plexus choroides*, *viz.* to ſeparate a ſerous matter from the arterial Blood. But in Man (according to the beſt Anatomiſts) this *Rete* is wholly wanting; ſo that there paſſing only ſometimes a twig or two, and ſometimes none, from the trunk it ſelf of the Carotid Artery into the *Glandula pituitaria*, that Gland is of leſs uſe in him than in other Creatures that have the *Rete.*

CHAP. VIII.

Of the Spinalis Medulla.

IT has been our method, whenſoever we have come to the riſe or origine of any part that is extended through ſeveral regions of the Body, to give a general deſcription of it through its whole extent, as if it all belonged to that region where its riſe is. Thus, for inſtance, we gave a general deſcription of all the Arteries of both Head and *Abdomen* as well as of the *Thorax* in our Anatomy of the middle Venter, becauſe they have all of them their riſe from the *Aorta*, that ſprings out of the left Ventricle of the Heart ſeated in that Venter. In like manner having deſcribed the *Medulla oblongata* within the Skull, we ſhall proſecute it in its deſcent down the *vertebræ* of the Neck, Back, Loins and *Os ſacrum*, wherein it is called the *ſpinal marrow*: But this very briefly.

Medulla ſpinalis.

We ſhewed above how its head (the *medulla oblongata*) was joined by the *corpora ſtriata* to the *corpus calloſum* of the Brain, as alſo by thoſe many protuberances that are upon it, both to the Brain and Cerebel from and through which the Animal Spirits are derived into it. Its trunk within the Brain (after its *crura* are united) is generally about an hands breadth long: but its length in the ſpine is very different according to the various ſtatures of Men.

Its Subſtance.

Its *Subſtance* is fibrous (which appears by the help of a Microſcope) as if it were compoſed of innumerable ſlender long filaments, which whether they are hollow or no cannot be diſcovered through their fineneſs.

Veſſels.

If one cut through its Subſtance, there will innumerable little ſpecks or ſprinklings of Blood appear, but the Veſſels are ſo ſmall that they cannot be diſcover'd. But there are plainly diſcoverable very many twigs of *Arteries* and *Veins* running through the Membranes that inveſt it (being principally branches of the *Cervical*) from which Arteries the Blood is infus'd into the pores of the *Medulla*, as it is imbib'd again from thence by the Veins.

Figure.

It is round and long, and decreaſeth not in its thickneſs by the Nerves that go out of it. But on the contrary (as Dr. *Willis* obſerves) "Where "the moſt and the largeſt Nerves ſpring from it, "it is there thickeſt, as particularly at the riſe "of the Brachial and Crural Nerves. Of which he gives this reaſon, "becauſe within the medullar tracts the Animal Spirits do not run down "and paſs by ſwiftly, but for the moſt part iſſuing leiſurely from their fountains, when they "have filled all ſpaces, they keep their aboad in

" them; and where more ſpirits are wont upon " occaſion to be ſpent on any work, there are " provided larger receptacles or ſtore-houſes for " them.] Only towards its end in the *Os ſacrum* it grows ſmaller and ſmaller.

Membranes. It hath three *Membranes.* The firſt is that which immediately cloaths it. This ſpringeth from the *Pia Mater*, and paſſeth through its middle (dividing it into two parts) alone without the outer. The twigs of Arteries and Veins run moſtly through this. The ſecond covereth the firſt, and ſpringeth from the *Dura Mater*. There is no diſtance between them, as there is in the Brain, but one toucheth another cloſe, being knit together by Fibres. The third, proceeding from the Ligament which tieth together the fore parts of the *Vertebræ*, covereth both theſe.

It's diviſion. It is *divided* all along from the very firſt meeting of its *Crura* within the Skull, to the end of *Os ſacrum*, by a membranous partition parting it into two, but this diviſion is not apparent in the Spine, becauſe of the *Dura Mater* that covers it; but it may be diſcovered if that be taken off, and the *medulla* ſevered in the middle. The partition is made of the *Pia Mater*, and by means of *It* it is that the uſe or motion of *one ſide* onely is ſometimes taken away in the Palſie.

As for the *Nerves* that ſpring out of it, thoſe ſhall be deſcribed after we have done with thoſe of the Brain.

CHAP.

CHAP. IX.

Of the Action of the Brain, and the (ſuppoſed) Succus nutritius *of the Nerves.*

IT is generally agreed that the proper *Action* of the Brain (taken in a large ſenſe) is the elaborating of Animal Spirits; and that they are ſent from it by the Nerves into the ſeveral parts of the Body, for performing both natural and animal Actions. But what and of what nature theſe Animal Spirits are, and in what particular part of the Brain they are generated, is not agreed upon by learned Men.

The Animal Spirits what, and of what made.

Steno thinks it not improbable, that the Animal Spirits are of the ſame nature with the matter of light. Dr. *Willis* ſuppoſes they are ſpirituo-ſaline, and that in the Muſcles they do efferveſce with a *latex* of a contrary nature ſupplied by the Blood, whence the Muſcle grows turgid, and conſequently contracts. Some are of opinion that they differ in no other regard from the Vital, but only as they are conveyed by proper Veſſels, and miniſter to other purpoſes and are of a cooler temperament; but that there is no ſpecifical difference betwixt them. Others on the other ſide think they differ *in ſpecie*, and agree in nothing, but only that the Vital Spirits and Blood are the matter out of which the Animal Spirits are formed. Another ſort deny the Arterial Blood to be the matter of theſe Spirits, and affirm that the Nerves of the Stomach, *&c.* abſorb a part of the Chyle, of which they are made, and beſides, a Nutritious Juice, (of which by and by.) And ſome there are that ſuppoſe Air alſo to be an Ingredient, which either aſcends into the Brain through the *Os cribriforme*, (and fills the Ventricles, according to *Fracaſſatus*) or inſinuates it ſelf into the Blood as that circulates through the Lungs. We cannot ſtand upon the examination and refutation of ſeveral of theſe Opinions here; but upon a due conſideration of the Arguments urged for each, we think that the Animal Spirits are ſpecifically diſtinct from the Vital, but that the Vital, with the Arterial Blood, their Vehicle, are the true and onely matter, out of which they are elaborated.

Where elaborated. And there is no leſs difference in what part of the Brain the Animal Spirits are made. Some deputing to that Office the *Sinus* of the *Falx*, others the four Ventricles of the Brain, eſpecially the fourth, a third ſort the *Plexus choroïdes* and *Rete mirabile*; *Des Cartes* thinks, that they are ſeparated out of the Arteries of *Plexus choroides* in the *Glandula pinealis* into the Ventricles; and others laſtly aſſign the ſubſtance of the Brain and Cerebel (eſpecially their cortical part) for the place of their confection. As to the *Sinus* of the *Falx*, the Uſe of that was ſhewn above, *Chap.* 3. And as to the Ventricles, ſeeing they are often almoſt *quite full* of wateriſh humour, but always have *ſome*, they ſeem very unfit for the making or ſtoring up ſuch ſubtile and volatile Spirits as the Animal are. As for the *Plexus choroïdes* and *Rete mirabile*, there is no Veſſel that goes out of either which contains any thing but under the form of Blood; (not to mention that the *Rete mirabile* is wanting in Men:) ſo that ſeeing there are no *Vaſa deferentia* (or call them what you will) to convey the Spirits from theſe *Plexus* to the origin of the Nerves, we cannot reaſonably aſcribe to them ſuch an Action. We muſt therefore ſubſcribe to the laſt Opinion that aſcribes this work to the very ſubſtance of the Brain and Cerebel, and is performed in this manner. The Heart is like the *Primum mobile* of the Body, to which the motion of all the humours, that have once paſt it, is owing. This by its *Syſtole* impells the Blood, as into all other parts, ſo into the Brain by the ſeveral branches of the *Carotides*, whoſe innumerable twigs run chiefly through the outer *Cortex* or greyiſh part of the Brain and Cerebel, and partly into the inner medullar or white ſubſtance. Theſe twigs of Arteries ſpring partly from the *Plexus choroides*, and *Rete mirabile* (in thoſe Creatures that have it) and partly from the *Carotides* themſelves immediately. The ſuperfluous *Serum* is ſeparated from the Blood contained in the Arteries before they enter into the Brain and Cerebel, by the Glands above deſcribed; and that Blood which is not elaborated into Animal Spirit in theſe parts, is returned again to the Heart by the Veins. But thoſe particles that are fit and proper to be converted into them, are extravaſated into the very *Parenchyma* of the Brain and Cerebel, (*viz.* their Cortical Part) or at leaſt are diſtributed through it by inviſible Capillaries, in which being perfected into Spirits, theſe by help of the Fibres or Filaments which the inner medullar ſubſtance of the Brain and Cerebel chiefly conſiſts of, are conveyed to the *Medulla oblongata* by the *Corpora ſtriata* and other proceſſes whereby the *medulla* adheres to the Brain and Cerebel; out of which *medulla* they enter the Nerves, whoſe inner ſubſtance is fibrous like the *medulla* from whence they ſpring. And the reaſon of this ſucceſſive motion from one to another, is the Pulſe of the Heart, whereby that which comes behind, always drives forward what is before. Whence the true cauſe of an Apoplexy (wherein motion and ſenſe are almoſt quite aboliſht) is very probably from the obſtruction or compreſſion, &c. of the Arteries in the Brain and Cerebel; whereby both little Blood and Vital Spirit can be conveyed thither to make Animal Spirit of, and alſo when it is made, it is not impelled thence into the *medulla oblongata*, nor out of it into the Nerves, to enable them to perform their functions.

The Succus Nutritius *of the Nerves.*

There is no leſs controverſie about the *Nutritious Juice* of the Nerves: ſome contending for it to that height, as to affirm that all the parts of the Body are *onely* nouriſhed by *it*, and not at all by the Blood, which by its rapid motion they ſay is liker to wear and carry away ſomething from the parts through which it paſſes, than to adhere to them for their reſtauration. Others are more moderate, and ſuppoſe that nouriſhment is diſpenſed onely to the ſpermatick parts by the Nerves, which the Nerves receive not from the Blood, but imbibing the moſt thin part of the Chyle out of the Stomach and Guts they carry it up to the Brain, from whence it is conveyed again by the ſame or other Nerves to the parts to be nouriſh'd by it. *Diemerbroeck* is of opinion, that the juice of the Nerves (which is as a Vehicle to the Spirits) being ſomewhat acid, does contribute or yield aſſiſtance to the nouriſhment of the ſpermatick parts, not as it is the matter of, but as it ſeparates from the Blood ſuch particles as are fit for, their nouriſhment. Whence it is, he ſays, that ſuch parts of the Body as are moſt exerciſed, and by conſequence into which moſt Animal Spirits flow, grow the ſtrongeſt, having more of ſuch particles of the Blood as are fit for their inſtauration, ſeparated in them. So they that are uſed to walk, will endure it better, than others that are not ſo uſed, though otherwiſe much ſtronger. And hence the right Arm is uſually ſtronger than the left, in thoſe that are right-handed (as we ſay.) But he thinks that the Nerves have no juice in them which they did not firſt receive from the Blood. Dr. *Willis* is much of his Opinion, ſaving as to this laſt particular; for he ſays, it is without doubt that the nervous Fibres and Filaments which cloath the ſenſory of the taſte, and the Bowels that ſerve concoction, do immediately take ſome taſte of the Aliments for the ſupply of the Brain, eſpecially at ſuch times as the Spirits are much waſted in too long faſting or over much exerciſe. But then that juice that may be ſuppoſed to be made thereof in the Brain, and to be diſpenſed by the Nerves into all the parts of the Body, he believes not to be the matter of the nouriſhment of any part whether ſpermatick or ſanguineous: but that it is as the *form* onely, and the Blood the *matter*, whoſe ſeveral particles being analyſed or ſevered by the ſaid juice, are directed and adapted by its *directive faculty* or *plaſtick power*, as it were, to ſuch parts reſpectively as they are ſuitable for. And from hence he draws a reaſon why paralytick parts do waſte ſo much, though the Blood flow plentifully enough into them, *viz.* becauſe the Nerves being obſtructed, and no Animal Spirits (with their Vehicle) paſſing by them, the particles of the Blood are not ſeparated for the ſupply of ſuch parts.] As for the nervous juice, it muſts needs be very little in quantity, ſeeing if one make a Ligature upon the Nerve, it will not ſwell betwixt the Head and Ligature, nor if one cut the Nerve in ſunder will any thing diſtill out of it. So that it ſeems very abſurd to think that it ſhould be ſufficient for the nouriſhment of *all* the parts of the Body, according to the firſt opinion. Nor does it ſeem reaſonable to imagine that the Chyle ſhould aſcend from the Stomach, *&c.* to the Brain by the Nerves, whiles this nervous juice that is contended for, with the Animal Spirits, is deſcending by the ſame; for one cannot conceive how ſuch contrary motions of liquors in the ſame Veſſel can be at the ſame time. Though from the ſudden refection that perſons ready to faint receive from ſpirituous liquors, *&c.* it be probable that certain *Effluvia* or ſubtil and ſpirituous vapours do enter the nervous filaments of the Mouth and Stomach, and recruit the Animal Spirits immediately, without fetching that compaſs that I believe all the Chyle does. And as the Nerves imbibe no Chyle from the Stomach, *&c.* ſo receive they no more from the Arteries, than ſome of its moſt ſpirituous and volatile particles elaborated in the Brain into Animal Spirits, which have indeed ſome little moiſture accompanying them as a Vehicle, but which is neither of a ſuitable nature nor of proportionable quantity for the nouriſhment even of the ſpermatick parts onely. For ſeeing the Nerves have no conſpicuous Cavity, but onely imperceptible Pores, by which any liquor can drill along them; ſuch liquor muſt needs be moſt thin and watery, and therefore unfit to be aſſimilated to any part. And laſtly, as to the Opinion that it ſeparates the particles of the Blood, and ſo diſtributes thoſe that are reſpectively proper for, unto, each part, as the ſulphureous to the fat, *&c.* or is to the Blood as the form is to the matter; it is an ingenious Hypotheſis I confeſs, but whether true, I dare not affirm.

CHAP. X.

Of the Nerves ariſing from within the Skull; and firſt of the firſt and ſecond Pair.

WE have now done with all the parts of the *Encephalos* wherein the Animal Spirits are either elaborated or ſtored up, and have alſo deſcribed the nature of the Spirits themſelves: it remains that we ſhew by what and how many Inſtruments they are diſpenſed to the parts for the performance of whoſe functions they are neceſſary. Theſe Inſtruments are the *Nerves*, all of which ſpring either out of the *Medulla oblongata* within the Skull, or out of the *Medulla ſpinalis* in the Spine. They all of them ariſe by *Pairs*, ſo that they are not reckoned to be ſo many *Nerves*, but ſo many *Pairs* of Nerves. As for the *Pairs* within the Skull, they were formerly reckoned to be but *ſeven*, ſumm'd up in theſe Verſes,

> *Optica prima; oculos movet altera; tertia guſtat:*
> *Quarta, & quinta audit; vaga ſexta; at ſepma linguæ eſt.*

But ſtricter Examination has found them to be more; Dr. *Willis* particularly has encreaſed them to the number of *Ten*, holding the *Proceſſus mammillares* to be the *olfactory* Nerves, and the *Par* *vagum* and *Intercoſtale* to be two diſtinct pairs: and laſtly, deſcribing a tenth pair, which deſcending out of the Skull with the *Medulla*, emerges betwixt the firſt and ſecond *vertebræ* of the Neck. We ſhall adhere to this account, and deſcribe the *Olfactory* and *Optick* in this Chapter, and the reſt afterwards in order.

Nervi Olfactorii, *the firſt pair,*

Their Riſe.

Of all the *pairs* of Nerves that riſe within the Skull, the *Olfactory* or ſmelling pair ariſe the foremoſt, and are therefore reckon'd for the firſt. They ſpring from the *Crura* of the *Medulla oblongata*, betwixt the *Corpora ſtriata* and the little hillocks or eminences out of which the optick Nerves riſe (called by *Galen* their *Thalami.*) Though *Diemerbroeck*, that (following the Ancients) denies them to be Nerves, affirms that they ſpring not from the ſaid *Medulla*, but from the globous marrow of the Brain (properly ſo called) and its fore Ventricles.

Progreſs.

From their riſe they run forwards under the *baſis* of the Brain, (encreaſing in bulk as they go) as far as to the *Os cribriforme* at the top of the Noſe, growing there into round proceſſes like Paps, being therefore called *Proceſſus papillares* or *Mammillares.*

Cavity and Subſtance.

They are manifeſtly hollow in their whole progreſs, and their ſubſtance is very marrowy and ſoft.

Inſertion.

Having arrived at the *Sinus* of the ſieve-like Bone, they there acquire coats of the *Dura Mater*; with which being clad, Dr. *Willis* ſays, they are divided into many Fibres and Filaments, which paſs out of the Skull through the holes in the ſaid Bone into the caverns of the Noſtrils, running through the Membrane that inveſts thoſe caverns.

Dr. *Willis* aſcribes a double *uſe* to them, making them both the true Organs of Smelling, and alſo Emunctories to the Brain, thinking that when too much *Serum* is collected in its Ventricles, theſe deriving it thence, ſend it forth by their filaments through the *Os cribriforme* into the Noſtrils. *Diemerbroeck* believes they have only this latter uſe; only that the *Serum* or *Lympha* diſtils from them as well upon the *Fauces* and their Glands, as into the Noſtrils. Dr. *Lower* grants only the *former*; and ſays, that "It is incredible that the "humour that is contained in the cavity of theſe "proceſſes ſhould iſſue out by the Nerves, *(or* "*Nervous Filaments)* into the Noſtrils, for if it "did, the ſenſe of Smelling muſt needs be much "prejudic'd thereby. And beſides, if this water "could diſtil by and out of the Nerves, much "more might the Spirits, that are thinner, and "more ſubtil, fly away. And as to the humour "contained in the cavity of the Proceſſes, he "ſuppoſes it to be of very great uſe: namely, "that when *Effluvia*, or moſt ſubtil Particles ex-"haling from an external object, are delivered to "the *Olfactory Nerves*, that their Species may "reach the Brain the better, it was neceſſary "that theſe Nerves or *Proceſſes* ſhould be made "hollow from their very riſe, and be filled with "a limpid humour: Not that I believe, *ſays he*, "that the Species themſelves are conveyed "through their cavities into the ventricles of the "Brain, or that the Animal Spirits are lodged in "thoſe Ventricles, as the Ancients thought; "but that they are therefore hollow and moiſten'd "within with water, that their marrowy Bodies "may ſerve the better both for retaining and "conveying Smells into the Brain; For as things

Uſe.

"ſmel-

" ſmelled are better perceived from moiſt Bodies " and in a moiſt Air, than in a dry ſeaſon from the " parched ground (as Huntſmen know too well) " ſo it is likely that in the ſame manner as they " are beſt perceiv'd outwardly, they are alſo beſt " conveyed inwardly, *&c.*] And indeed, if we will allow them to be Olfactory Nerves, (as I think there is great reaſon) it is very incongruous that they ſhould ſerve for an Emunctory to the Brain, to diſcharge its ſuperfluous *Serum.* And therefore we think it fit to acquieſce in this Learned Phyſician's Opinion; and to believe that the *Lympha* or *Serum* gathered in the ventricles of the Brain, is emptied by thoſe ways we before obſerved out of the ſame Author, and not at all by the nervous Filaments that paſs from theſe Proceſſes through the *Os cribriforme* into the Noſtrils.

Nervi optici, *the ſecond pair. Their riſe.*

The *ſecond pair* are the *Optici* or *Viſorii Nervi*, which beſtow upon the Eyes the faculty of ſeeing. They ſpring from the upper ſides of thoſe unequal protuberances of the *crura* of the *Medulla oblongata*, which are called *Nervorum opticorum thalami*; from whence being carried forward, and ſomewhat downwards, after having fetcht a compaſs, they meet one another about the *Infundibulum*, upon the *ſella* of *Os ſphenoides*; where they are united by the cloſeſt conjunction, but not confuſion, of their Fibres, which run parallel lengthways in theſe Nerves, as they do in all other.

Cavity.

They are obſcurely hollow until they be united; but after, their hollowneſs cannot be diſcerned. This hollowneſs may be ſhewed in a large Beaſt newly killed, and in a clear light.

Thus do *Riolanus*, *Gliſſon*, *&c.* teach. But *Veſalius*, *Aquapend.* *&c.* deny that they have any manner of cavity. *Malpighius* ſays, "They have "not one cavity only, but ſundry; but that theſe "cavities reſult only from the neceſſity of their "ſtructure, all their inner or medullar part con-"ſiſting of round *Inteſtinula* or Fibres running "lengthways, which cannot be ſo cloſely fitted "to one another, but that there will reſult long "Interſtices, which yet perhaps are of no uſe, nor "of the nature of Ducts, but only accidental. "But whether the *Inteſtinula* or Filaments them-"ſelves have not little chanels in them, (like to "Blood-veſſels) he thinks may be doubted of: "But ſeeing ſenſe has not yet diſcovered any ſuch, "'tis probable that there are to be admitted only "little Pores and Interſtices in the medullar ſub-"ſtance, by means whereof the nouriſhing and vi-"vifying juice may be propagated.

De Cerebr. p. 22.

Inſertion.

After their unition they are ſeparated again, and each of them running further forwards, paſſes through an hole of *Os cuneiforme*, and is inſerted obliquely into the centre of the Eye of its own ſide.

Veſſels.

Dr. *Willis* ſays, they receive not only nervous Fibres from the third pair of Nerves, but alſo twigs of Arteries from the fore-branches of the *Carotides*, which run upon them as far as the *baſis* of the Eye. Whence, he thinks, a Reaſon may be aſſign'd, why, when a man grows ſleepy after plentiful eating or drinking, he preſently feels a notable heavineſs or oppreſſion as it were about his Eyes. For when the Blood becoming very turgid fills the veſſels that run through the Brain, more than uſual, and by diſtending them ſtops the pores of the Brain; theſe Nerves alſo in their whole courſe are compreſſed by the Blood that is become turgid in their Blood-veſſels likewiſe.

Subſtance and parts.

They are very ſoft, ſo long as they are within the Skull, but having paſs'd the *Os ſphenoides*, they become ſomewhat more firm and hard. The reaſon of which alteration ſeems to be, that within the Skull they are only clad with the *Pia Mater*, but as they go out, they aſſume a ſecond coat from the *Dura Mater*.

They make the proper tunicles of the Eyes.

From the whole ſubſtance of theſe Nerves, *viz.* from their two Membranes and the inner medullar and fibrous ſubſtance, are the three (proper) Tunicles of the Eyes framed; for the *Cornea* or *Sclerotica* doth proceed from the *Dura Mater*, the *Choroides* or *Uvea* from the *Pia mater*, and the *Retina* from the marrowy ſubſtance.

CHAP. XI.

Of the third and fourth Pairs.

The third pair. Their beginning.

THE *third Pair* are termed *Motorii oculorum*, becauſe they move the Muſcles of the Eyes. They have their beginning at the innermoſt part or *baſis* of the trunk of the *Medulla oblongata* behind the *Infundibulum*.

Why both the Eyes are directed to the ſame object.

This pair is united at its riſe; whence is commonly drawn a reaſon why one Eye being moved towards any object, the other is directed alſo to the ſame. But though this conjunction may be a reaſon why the Spirits ſhould flow equally to the Muſcles of each Eye; yet it ſatisfies not why they ſhould flow at the ſame time, into different Muſcles. As for example; Why, when one would look to the right ſide, the Spirits are preſently determin'd into the *external muſcle* of the right eye, and into the *internal* of the left; and not into the external, or internal of both. And therefore a truer reaſon of both Eyes being moved together to one object, is the intention of the mind, which aiming only to have a view of one object at one time, directs the ſpirits to thoſe Muſcles only that ſerve to turn the Eye towards that object, &c.

Their ſubſtance and branches.

They are ſmaller and harder than the former, and preſently parting one from the other, they paſs along by the optick pair, and penetrating the ſecond hole of *Os cuneiforme*, are carried towards the globe of the Eye, where each is divided into four branches. The firſt whereof mounting above the Optick, is beſtowed upon the attollent Muſcle, and the Eye-lid. The ſecond is inſerted into the adducent Muſcle by ſundry ſmall twigs. The third by many Fibres is inſerted into the depriment Muſcle. The fourth paſſing further in a ſingle trunk, is implanted into the middle of that Muſcle that draws about the Eye obliquely downwards to the inner corner. At that place where this Nerve divides it ſelf into four branches, it forms a little round *Plexus*, out of which many ſlender twigs ariſe that creep through the trunk of the Optick Nerve, ſerving perhaps to widen or ſtraiten it as there is occaſion.

The fourth pair.

Their beginning, march and inſertion.

The *fourth Pair* proceed from the top of the *Medulla oblongata*, (contrary to all others, which ariſe either from its *baſis*, or ſides) behind the round protuberances called *Nates* and *Teſtes*: whence bending forwards by the ſides of the *Medulla oblongata*, they preſently hide themſelves under the *Dura Mater*; under which proceeding a while, a while, they paſs out of the Skull each in a ſingle trunk at the ſame hole with the others deſigned for the Eyes, (communicating with no other Nerves in their whole progreſs) and are beſtowed wholly (as Dr. *Willis* affirms) on that Muſcle of the Eye called *Trochlearis*, which ſerves to rowl the Eye about. Which motion of the Eye being generally attendent upon or expreſſive of ſome *paſſion* of the Mind, as Love, *&c.* theſe Nerves are thence called *Oculorum pathetici.*

CHAP. XII.

Of the fifth, ſixth, and ſeventh Pairs.

The fifth pair. Their riſe. THE *fifth pair* ſpring from the ſides of the *Medulla oblongata* where it is encompaſſed with the annular proceſs or protuberance of the Cerebel, (or,as Dr. *Willis* will have it, from that proceſs it ſelf.) Each trunk is very large and broad, conſiſting of very many Fibres, ſome ſoft, and ſome hard : So that it ſeems to be not one ſingle Nerve, but a collection or bundle of many ſmall ones, ſome of which are deſigned for one part, ſome for another ; ſome ſerving for motion, and others for ſenſe. And the reaſon why they are *all* united together in their riſe, the ſaid Author thinks to be, that there may be a ſympathy and conſent of actions in the ſeveral parts to which they are diſtributed. Whence it is that ſeeing or ſmelling what is pleaſing to the Appetite makes ones Mouth water, *&c.* becauſe this pair of Nerves ſends twigs both to the Eyes, Noſtrils, Palate, and Tongue, *&c.*

Diviſion and progreſs.

Each trunk is divided into *two* notable branches, ſometimes before, but oftener after it has penetrated the *Dura Mater.* The *firſt* whereof tending ſtreight downwards, and paſſing out of the Skull by its proper hole, in its deſcent towards the lower Jaw (for whoſe parts 'tis chiefly deſign'd) is divided into many leſſer Branches, which provide for the temporal Muſcle, as alſo for the Muſcles of the face and cheeks. From theſe alſo there go twigs to the Lips, Gums, roots of the Teeth, *Fauces*, Tonſils, Palate, and Tongue. The *ſecond* Branch of this fifth pair, being the larger, goes a little ſtreight forward by the ſides of the *Sella Turcica*, and over againſt the *Glandula pituitaria* ſends little twigs to the trunk of the *Carotides*, or to the *Rete mirabile* in ſuch creatures as have it: then inoſculates with the Nerve of the ſixth pair, and afterwards ſends back a ſlip or two, which being united with another ſlip returned from the Nerve of the ſixth pair, conſtitute the root or firſt trunk of the *Intercoſtal pair*, which we ſhall reckon for the ninth, and ſpeak of it by and by. After this it is divided into *two* notable branches: The *leſs* and *upper* whereof tends towards the globe of the Eye, and being again divided ſends forth two other, the firſt of which is parted into two more, that go one to the Noſe, and the other to that Muſcle of the Eye which is proper to Brutes; and the ſecond into four or five ſlips, that are moſtly ſpent on the Eye-lids, but partly on the *Uvea tunica* and the Glands of the Eye. The *greater branch* (of its ſecond diviſion) being carried towards the orbit of the Eye, is divided into two new branches. The *lower* whereof bending downwards, is beſtowed on the Palate and upper region of the *Fauces*;

and the *upper* being carried beyond the orbit of the Eye, paſſes through an hole of the upper Jaw, with the Vein and Artery which it twiſts about, and ſends many ſlips to the Muſcles of the Cheeks, Lips, Noſe, and roots of the upper Teeth. From its twiſting about the ſanguiferous veſſels deſigned for the Cheeks, and other parts of the Face, may a reaſon be drawn why one bluſhes when he's aſham'd: for the Animal Spirits being diſturbed by the imagination of ſome uncomely thing, as if they took care to hide the Face, enter this Nerve diſorderly; ſo that its twigs embracing theſe ſanguiferous Veſſels, by compreſſing and pulling of them, cauſe the Blood to flow too impetuouſly into the Cheeks and Face by the Arteries, and detain it there ſome time by conſtringing the Veins.

The ſixth pair. Their riſe and inſertion.

The *ſixth* pair riſe juſt by (but below) the fifth, and each preſently ſinking under the *Dura Mater*, goes out of the Skull by the ſame hole with the Nerves of the third and fourth pair, and is carried by a ſingle trunk towards the orbit of the Eye; but ſo, as by the ſide of the *Sella Turcica* it inoſculates with the ſecond or greater branch of the fifth pair, (as was noted in the former Paragraph:) whence ſending back ſometimes one, ſometimes two twigs, theſe being united with the recurring twigs of the fifth pair (above-mentioned) make the beginning of the *Intercoſtal Nerve.* Afterwards going forwards, near the orbit of the Eye it is divided into two Branches; of which *one* is inſerted into the abducent Muſcle of the Eye placed in its outer corner; and the *other* being cleft into many Fibres, is beſtowed on the ſeventh Muſcle proper to Brutes, whereby they defend the Eye from external Injuries accidentally occurring, when they are ſaid *nictitare* (which I think we have no word to expreſs in Engliſh.)

The ſeventh pair. Their riſe and inſertion.

The *ſeventh* pair, by the Ancients commonly reckon'd for the fifth, miniſter to the ſenſe of Hearing. Each Nerve has two Proceſſes, one ſoft, and the other harder, which might ſeem to be two diſtinct Nerves, but they are uſually accounted for one. They ſpring a little behind the former, out of the ſides of the *Medulla oblongata.* Dr. *Willis* ſays, the *ſofter* proceſs ariſes from the lower ſide of the annular protuberance, from whence it aſcends; and the harder from its upper part, from whence deſcending it meets the other. The *ſoft* part or proceſs (that is properly the auditory Nerve) is carried through an hole of *Os petroſum* into the cavern of the Ear, which it cloaths with a moſt thin Membrane. By this are ſounds conveyed to the common Senſory. The *harder* proceſs ſerves rather for motion than ſenſe; which paſſing out alſo through the *Os petroſum*, by its proper hole, preſently admits a twig from the *Par vagum* or eighth pair, after which it is immediately divided into *two* branches; *one* whereof tending downwards, is beſtowed on the Muſcles of the Tongue and *Os hyoides*; and the *other* winding about the auditory paſſage, and bending upwards, is divided into three twigs; of which the *firſt* correſponding to the Nerve of the firſt diviſion, beſtows certain ſlips on the Muſcles of the Lips, Mouth, Face and Noſe, and ſo actuates ſome outward organs of the Voice, as the former ſome of the inner; the *ſecond* is diſtributed to the Muſcles of the Eye-lids and Forehead, and the *third* to the Muſcles of the Ears. Whence upon ſome unuſual and aſtoniſhing ſound, by a certain natural inſtinct, the Ears prick up, and the Eyes open. As alſo the voice does officiouſly anſwer as an Echo to thoſe ſounds that are perceived by the Ears, from the community of the Nerves diſtributed to the organs of the voice and hearing.

CHAP. XIII.

Of the eighth, ninth, and tenth Pairs.

The eighth pair.

THE next *Pair* in order is the *eighth*, which has uſed to be reckoned for the ſixth, and is otherwiſe called *par vagum*, or the *wandring pair*, from their being diſtributed to ſundry parts.

Their riſe.

They ſpring below the auditory Nerves, out of the ſides of the *Medulla oblongata*, the root of each Nerve conſiſting of twelve Fibres at leaſt (in Man) to which a notable Fibre, or rather *Nerve* (much greater than any of theſe twelve) coming from the ſpinal marrow as far as from about the ſixth or ſeventh *vertebra* of the Neck, is joyned, and both are inveſted with the ſame Coat from the *Dura Mater* as if they grew into one Nerve; but if their common Coat be removed, this acceſſory Nerve, and many of the other Fibres remain ſtill diſtinct, and after they are gone out of the Skull together, are diſpenſed to ſeveral parts; the acceſſory Nerve to the Muſcles of the Neck and Shoulder-blade; and one notable Fibre of the eighth pair to the harder proceſs of the Auditory or ſeventh pair, as alſo two others to the Muſcles of the Gullet and Neck. But the other Fibres of this *par vagum* continue united, and inſtead of thoſe companions they have parted with, each Nerve entertains a new one, namely a branch from the *Intercoſtal* or *ninth* pair, whereby is made a notable *Plexus* (which in a Nerve is like the Joint of a Cane, or the Knot upon the Trunk of a Tree where a Bough goes out, whence they are called *ganglioformes*) and out of the ſame *Plexus* there ſprings a conſiderable branch, which being carried towards the *Larynx* is divided into three twigs, of which one goes to the ſphincter of the Gullet, a ſecond to the upper Muſcles of the *Larynx*, and the third going under the *Cartilago ſcutiformis*, meets the top of the recurring Nerve and is united to it; Below the aforeſaid *Plexus* of this *par vagum*, each trunk goes ſtreight down by the ſides of the aſcending *Carotides*, on which they beſtow ſome ſlips. And at the bottom of the Neck each receives a ſecond branch from the Intercoſtal, (*viz.* from its firſt *Plexus*) and near thereto the left Nerve of this pair ſends out another twig into the recurrent Nerve, but ſo does not the right. From hence both trunks deſcend without any notable ramification, till they be come over againſt the firſt or ſecond Rib; where out of a ſecond *Plexus* (or knot) many Twigs and Fibres go towards the Heart and its appendage, from whence this *Plexus* is called *Cardiacus.* There is one notable difference (which we cannot but note) of the two *recurring Nerves* that ſpring out of the trunks of this eighth pair, *viz.* That that on the right ſide ariſes out of it higher and windes about the Axillar Artery; whereas that on the left ſprings much lower therefrom, and twiſting about the deſcending trunk of the *Aorta* returns back from thence. Dr. *Willis* ſays that the *recurring Nerve* is really a diſtinct Nerve from the *Par vagum*

Progreſs.

from the very Original, and was onely included in the ſame caſe or cover for the more convenient and ſafe paſſage. The branches of the *Par vagum* do frequently unite with others of the Intercoſtal pair about the *Præcordia.* And when their two Trunks are deſcended as low as over againſt the Heart, many twigs go out of them into the Lungs, *&c.* Whence both trunks deſcending by the ſides of the Gullet are divided into two branches, *outer* and *inner:* The outer unite with the outer, and the inner with the inner, and both deſcend to the Stomach, in which *End.* they terminate, but are ſpent chiefly upon its upper orifice. As for their more particular diſtribution, we have ſpoke thereof while we treated of the parts themſelves on which they are beſtowed.

The ninth Pair. We are next to deſcribe the *ninth pair* (which before Dr. *Willis* was not diſtinguiſhed from that going before.) It is called the *Intercoſtal*, becauſe as its Trunks march down by the roots of the Ribs, betwixt every Rib they receive a branch *Their Riſe.* from the ſpinal Marrow. They have no proper root of their own, but each trunk is compounded of two or three recurring branches of the fifth and ſixth pairs, (near their origine) as was noted *Progreſs.* when we treated of thoſe pairs. Being thus formed they paſs out of the Skull by their proper holes, and preſently each has a *Plexus* near thoſe of the *Par vagum*, into which, two nervous proceſſes from the tenth pair of the Brain are inſerted, and out of which there goes a twig into the ſphincter of the Gullet, and into the *Plexus* (aforeſaid) of the *Par vagum.* Whence deſcending by the *vertebræ* of the Neck, by that time they arrive at its middle, each has another greater *Plexus*, *into which* a large Nerve from a neighbouring vertebral pair is inſerted; and *from which* proceed many twigs that uniting with others of the *Par vagum* are diſtributed all about the *Præcordia*, as alſo one ſingle one a little lower. This *Plexus cervicalis* out of which ſo many branches ſpring, is proper to Man, being not found in Brutes. From the Neck they deſcend by the *Claviculæ* into the *Thorax*, where having arrived at the ſecond Rib, each receives three or four branches from the vertebral Nerves next above, whereby is made another notable *Plexus* (commonly called the *Intercoſtal.*) From whence as they paſs down by the roots of the Ribs, in every one of their Interſtices and even as low as *Os ſacrum*, from every jointing of the *vertebræ* each receives a vertebral branch. Aſſoon as they are deſcended out of the cavity of the Breaſt, and are come over againſt the Stomach, each ſends forth a notable branch, which tending towards the Meſentery, make its chief *Plexus*, which are in number *ſeven*, *five large* ones which are *upper*, and *two leſs* that are *lower*. For each branch is preſently divided into two other, and every one forms one *Plexus*, which make four; and the fifth is in the middle of theſe, being the largeſt, and like the Sun amongſt the Planets (as Dr. *Willis* compares it.) And theſe are the *five upper*. The *two lower* are framed of branches that ſpring from the trunks deſcended as far as the lower part of the Loins, and are diſtinguiſhed by the names of *Plexus Infimus*, and *Minimus*. As to the parts that all the twigs which ſpring from theſe ſeven *Plexus* are diſtributed to, it may be learned from the deſcription of the parts themſelves in the *Firſt Book*; in

which

which we conſtantly mentioned from whence each part had its Nerves. Laſtly, when this Intercoſtal pair is come to the *Os ſacrum*, its two Trunks bend toward each other, and ſeem to be knit together by two or three Proceſſes, and at length each of them *ends* in ſmall Fibres that are diſtributed into the Sphincter of the *Anus*.

End.

The tenth Pair. Their Riſe and Progreſs.

We are now come to the *tenth* and laſt pair of Nerves that riſe from the *medulla* within the Skull. This pair ſpring from the ſides of the *medulla*, behind all the reſt, and deſcending with it out of the Skull into the *vertebræ* of the Neck, they come out betwixt the firſt and ſecond *vertebræ* thereof. Preſently after their egreſs each ſends forth a branch into the *Plexus* of the Intercoſtal Nerve of its own ſide: but their main trunks being carried downwards, and each receiving a twig from the ninth pair, they are beſtowed on the Muſcle *ſternothyreoideus*, and ſome other Muſcles of the Neck. So that though this pair riſe within the Skull, yet it ſeems to be more of the nature of the Vertebral Nerves, as beſtowing ſome branches on the Intercoſtal, and being all the reſt of it ſpent upon the Muſcles of the Neck.

And thus we have done with all the Nerves that proceed from the *Medulla* within the Brain, in deſcribing of which we have followed Dr. *Willis* for the moſt part, that moſt accurate Tracer of them.

Tab.

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Tab. XIV.

Fig. 1.

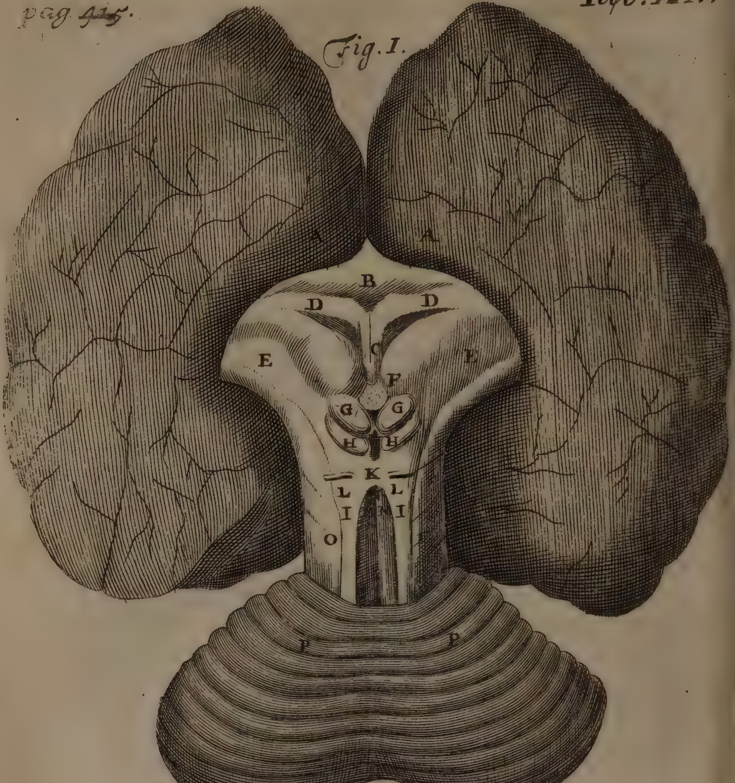
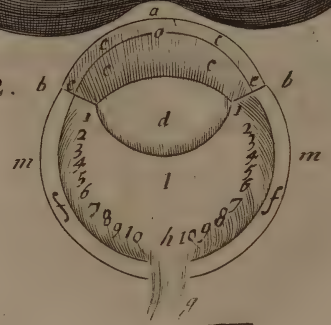


Fig. 2.



Tab. XIV.

Fig. I. Repreſenteth the outer or upper ſuperficies of the Brain taken out of the Skull; where the *Limbus* of the Brain being looſed from its coherence with other parts by Membranes, is lifted up and bent forwards, that the *Crura* of the *Medulla oblongata*, the *Fornix*, *Nates* and *Teſtes* with the *Glandula pinealis*, and other proceſſes may be clearly and diſtinctly ſeen, (from Dr. *Willis.*)

AA *The* Limbus *of the Brain, which in its natural Situation was contiguous to the* Cerebellum.
B *The Bordure or Margent of the* Corpus calloſum *ſpread over both Hemiſpheres of the Brain, which in its natural Situation lay upon the* Glandula pinealis.
C *The* Fornix.
DD *Its Arms embracing the* Crura *of the* Medulla oblongata.
EE *The* Crura *of the* Medulla oblongata, (*out of which the optick Nerves proceed*) *whoſe Ends* (*being placed further out of ſight*) *are called* Corpora ſtriata.
F *The* Glandula pinealis, *betwixt which and the root of the* Fornix *is the chink that leads to the* Infundibulum.
GG *The orbicular Protuberances called* Nates.
HH *The leſſer Protuberances called* Teſtes, *which are Proceſſes of the former.*
II *The Medullary Proceſſes, which aſcend obliquely from the* Teſtes *to the* Cerebellum, *and make a part of each of its* Meditullia.

K *The joining of thoſe Proceſſes by another tranſverſe Proceſs.*

L *The Riſe of the pathetick Nerves (or fourth pair) out of the joining of the aforeſaid Proceſſes.*

MM *A portion of the* Medulla oblongata *lying under the aforeſaid Proceſſes and Protuberances.*

N *The* Foramen *of the Ventricle or Cavity that lies under the orbicular Protuberances.*

OO *A portion of the annular Protuberance let down from the* Cerebellum *and embracing the* Medulla oblongata.

PP *The outer and upper Superficies of the* Cerebellum.

Figure II.

Repreſenteth the Eye cleft in two (from behind forwards) that the divers Situation of the humours may appear, (from Dr. *Briggs.)*

b a b *The* Tunica cornea, *or fore and more convex arch of the Eye.*

c c *The* Tunica uvea (*whoſe* Foramen o *is called the* Pupilla) *ſwimming in the watry humour* cccc.

d *The Cryſtalline humour* in ſitu.

f f *The* Tunica choroides, *which in this Figure (as being two much ſeparated from the* Sclerotica mm) *cannot be duly repreſented.*

g *A portion of the Optick Nerve.*

h *Some of its ſmall Fibres cut off near the* exit *of the Nerve.*

I *The Centre of the* Humor Vitreus, *and of the* Retina.

1, 2, 3, 4, 5, &c. *The* Capillamenta *of the Optick Nerve, whoſe ends on each ſide being cut off did adhere to the* Ligamentum ciliare (*namely by the Region of the Cryſtalline humour.)*

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Tab. XV.

Fig. 1.

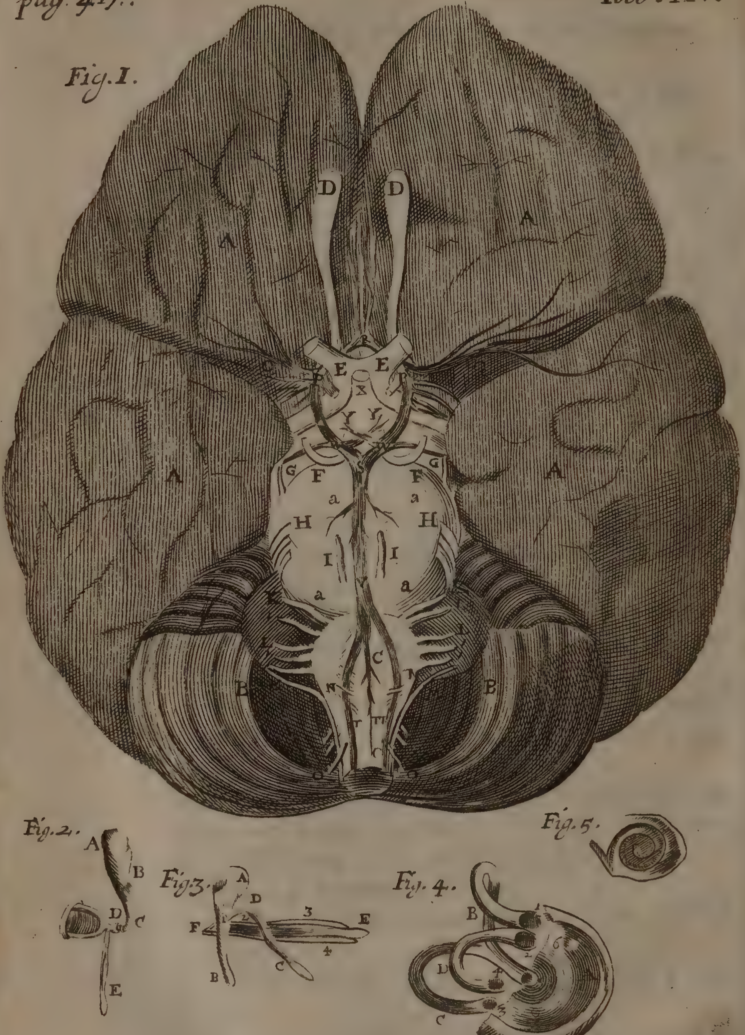


Fig. 2.

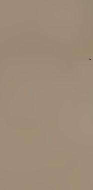
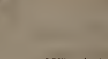


Fig. 3.

Fig. 4.

Fig. 5.



Tab. XV.

Fig. I. Repreſenteth the Baſis of an Humane Brain taken out of the Skull, with the Roots of the Veſſels cut off ſhort, (from Dr. *Willis.*)

AAAA *The fore and hinder Lobes of the Brain.*
BB *The* Cerebellum.
CC *The* Medulla oblongata.
DD *The Olfactory Nerves, or firſt Pair.*
EE *The Optick Nerves, or ſecond Pair.*
FF *The Motory Nerves of the Eyes, or third Pair.*
GG *The Pathetick Nerves of the Eyes, or fourth Pair.*
HH *The fifth Pair.*
II *The ſixth Pair.*
KK kk *The Auditory Nerves, and their two Proceſſes on each ſide, the ſeventh Pair.*
LL lll, &c. *The* Par vagum *or eighth Pair, conſiſting of ſeveral Fibres.*
MM *The Spinal Nerve coming from afar to the Origine of the* Par vagum.
NN *The ninth or Intercoſtal Pair, conſiſting alſo of many Fibres (that tending downwards, unite into one Trunk) which emerges a little above the Proceſs of the* Occiput.
OO *The tenth Pair tending downwards.*
PP *The Trunk of the Carotid Artery cut off, where it is divided into the fore and hinder Branch.*
QQ *Its Branch paſſing betwixt the two Lobes of the Brain.*
R *The fore Branches of the* Carotides, *being united, part again, and proceed to the Fiſſure of the Brain.*

S *The hinder Branches of the* Carotides *united, and meeting the Vertebral Trunk.*

TTT *The Vertebral Arteries, and their three aſcending Branches.*

U *The Branches of the Vertebral Arteries uniting into the ſame Trunk.*

WW *The place where the Vertebral and Carotid Arteries are united, and a Branch on either ſide aſcends to the* Plexus choroides.

X *The* Infundibulum.

YY *Two Glands placed behind the* Infundibulum.

aaaa *The annular Protuberance which proceeding from the* Cerebellum *embraces the Trunk of the* Medulla oblongata.

Fig. II. Exhibits a ſide-view of the Anvil and Stirrup (two bones in the firſt cavity of the Ear) *in ſitu*, from Monſ. *du Verney.*

A *The thick part of the Anvil.*

B *The ſhort Branch which in this ſituation we behold fore-right.*

C *The long Branch.*

D *The Head of the ſtirrup which is joined with the long Branch, the fourth little bone coming between.*

E *The Muſcle that is inſerted into the Head of the Stirrup.*

Fig. III. Repreſents the Hammer (a third Bone in the ſame cavity) on its fore-ſide with its Muſcles *in ſitu*, from the ſame Author.

A *The Head of the Hammer.*

B *The Handle.*

C *The external Muſcle of the Hammer.*

D *Its Inſertion.*

E *The internal Muſcle.*
F *The place where it is fitted for its Inſertion into the Handle of the Hammer underneath the external Muſcle.*
1. *The great Proceſs of the Hammer in a direct View.*
2. *The ſlender Proceſs into which the external Muſcle is inſerted.*
3. 4. *The nervous Covering of the internal Muſcle opened in the middle, that the Muſcle may be ſeen.*

Fig. IV. Shews a portion of the *Veſtibulum* or entrance of the Labyrinth (a ſecond cavity of the Ear) with its three ſemicircular Canals, from the ſame Author.

A *The lower part of the* Veſtibulum.
B *The upper Canal.*
C *The lower.*
D *The middle.*
1. *The entrance of the upper ſemicircular Canal.*
2. *The firſt entrance of the middle Canal.*
3. *The entrance of the lower Canal.*
4. *The other entrance of the middle Canal.*
5. *The common entrance to the upper and lower Canals.*
6. *The firſt Hole that gives a paſſage to one of the Branches of the ſoft part of the auditory Nerve.*
7. *The ſecond Hole that gives a paſſage to another Branch of the ſame Nerve.*

Fig. V. Shews the *Cochlea*, which the foreſaid Author makes a part of the Labyrinth, but other Anatomiſts call a third Cavity.

CHAP.

CHAP. XIV.

Of the Nerves of the Spinalis medulla; *and firſt of the Nerves of the Neck.*

WE obſerved above, that when the *Medulla oblongata* is deſcended out of the Skull into the Spine, it loſes its name of *oblongata*, and acquires that of *Spinalis*, (which name it borrows from the *Spine* through which it paſſes) but is of the ſame fibrous or filamentous ſubſtance as it was within the Brain. And now we come to deſcribe the *Nerves* that ſpring out of it, which aſſiſt the motion of all thoſe parts, which thoſe ten pair already deſcribed, that ariſe within the Skull, reach not to.

Nerves ſpringing from the Spinalis medulla.

In its whole progreſs from the Skull to the *Coccyx*, there ſpring out of it *thirty* pair of Nerves: *ſeven* of which are of the Neck, *twelve* of the *Thorax*, *five* of the Loins, and *ſix* of *Os ſacrum*.

The *firſt* and *ſecond* pair of the *Neck* come not out of the ſides of the *Vertebræ*, as all the reſt do; but becauſe of the peculiar articulation of the two uppermoſt *vertebræ*, ſpring out before and behind.

Seven of the Neck. The firſt pair.

The *fore* Nerve of the *firſt* pair cometh out between the bone of the *Occiput* and the firſt *vertebra* of the Neck, and is beſtowed upon the Muſcles of the Neck which lie under or behind the *Oeſophagus*, and on the skin of the Face. The *hinder* Nerve cometh out of the hole which is common to the *Os occipitis* and the firſt *vertebra* of the Neck. This hath two twigs: The ſmaller is beſtowed upon thoſe Muſcles which lie upon the *Occiput*, and upon the skin of the Head as high as the Crown; the bigger is inſerted into the Muſcle which lifteth up the Shoulder-blade.

The ſecond. The *fore* Nerve of the *ſecond* pair (which is ſmaller) cometh out between the firſt and ſecond *Vertebræ*, and is beſtowed upon the Skin of the Face. The *hinder* cometh out of the ſides of the hinder proceſs of the ſecond *Vertebra*, but preſently is parted into two twigs. The thicker of which is beſtowed upon the whole Skin of the Head even to the Crown; The ſmaller upon the greater ſtreight, and the lower oblique Muſcles which ſtretch out the Head. Dr. *Willis* ſays, that the firſt and greateſt root of the *Nerve of the Diaphragm* ariſeth from the ſecond pair of the Neck: of which Nerve we ſhall ſpeak more by and by.

The five remaining pairs of the Neck, as alſo all the pairs of the Back and Loins, and the firſt of *Os ſacrum*, come out of the lateral holes betwixt the *Vertebræ*, and immediately after their *exit* are divided into the *fore* and *hinder* branches, and are diſtributed as followeth.

The third. The *third* pair come out of the *lateral* holes between the ſecond and third *Vertebræ*, and each being immediately divided into two branches, the *formore* thereof have each four twigs: The firſt is inſerted into the *long* Muſcle, or the firſt of the benders forward of the Neck; The ſecond deſcending is beſtowed upon the Muſcles which lie under the *Oeſophagus*, being firſt united to a twig of the fourth pair; The third aſcending goeth to the Skin of the back-part of the Head, having firſt joyned with the thicker twig of the hinder Nerve of the ſecond pair: The fourth is beſtowed upon the tranſverſe Muſcles of the Neck, and the Muſcle which lifteth up the Shoulder-blade. The *hinder* Branches are beſtowed upon the ſecond pair of Muſcles which heave up or widen the Breaſt.

The fourth. The *fourth* pair come out of the holes common to the third and fourth *Vertebræ*, the *formore* branches whereof are each divided into three twigs: The firſt of which uniting with a twig of the third pair is beſtowed on the firſt of thoſe Muſcles which bend the Neck forward called *Longus* (as abovefaid;) The ſecond upon the tranverſe Muſcle of the Neck, and the *Cucullaris* of the Shoulder-blade; The third being ſlenderer than the other two, is joined with a twig of the fifth pair, and both with one of the ſixth, and laſtly all three (according to Dr. *Willis)* with that of the ſecond pair above-mentioned: and the Trunk made up of all theſe deſcendeth by the ſides of the Gullet down the Neck and *Thorax* without any branchings till it come to the Diaphragm, where it is divided again into three or four twigs, on each ſide, and is inſerted into its fleſhy or muſcular part, being known by the name of *Nervus diaphragmatis*, or *Phrenicus*, (of which we have diſcourſed more largely in Book II. Chap. 3. *Of the Midriff.*) The *hinder* branches go back to the Spine under the Muſcles of that part, upon which they beſtow twigs, and going down between the Muſcles of each ſide of the Neck, each is carried to the *Muſculus quadratus* of its own ſide that draweth the Cheek down.

Nervus phrenicus.

The fifth. The *fifth* pair iſſue out between the fourth and fifth *Vertebræ*, the *formore* branches whereof have each four twigs: The firſt goeth to thoſe Muſcles that bend the Neck forward: The ſecond is that which joineth with the twigs of the ſecond, fourth and ſixth pairs, and makes up the *Nervus phrenicus*: The third goeth to the Muſcle *Deltoïdes*: The fourth goeth to the ſame *Deltoïdes*, and to the *Coracohyoideus*, or the third Muſcle of the *Os hyoides*. The *hinder* branches bend back to the Spine, and are beſtowed upon the Muſcles there, as the like branches of the fourth pair were.

The ſixth.

The *ſixth* pair come out between the fifth and ſixth *Vertebræ*. Their *formore* Branches ſend forth firſt one twig to make the Trunk of the *Nervus phrenicus*; then proceeding further they are united with the like branches of the three following pairs, namely the laſt of the Neck and two firſt of the *Thorax*, making on each ſide one *Plexus* with them, out of which thoſe Nerves proceed that are carried to the Arms. The *hinder* branches go to the Muſcles behind, which ſtretch out the Neck and Head, or bend them backward.

The ſeventh.

The *ſeventh* pair come out of the holes common to the ſixth and ſeventh *Vertebræ*. The *formore* and larger branches are joined with the like of the ſixth of the Neck and two firſt of the *Thorax*, as aforeſaid, furniſhing Nerves to the Arms. The *hinder* and ſmaller are beſtowed upon the Muſcles of the Neck, and quadrat Muſcles which pull down the Cheeks.

Nervus ad par vagum acceſſorius.

About where theſe ſixth or ſeventh pairs of Nerves riſe, there ſprings on each ſide another Nerve, deſcribed by Dr. *Willis*, and by him called *Nervus ſpinalis ad par vagum acceſſorius*. They riſe ſmall out of the ſides of the ſpinal Marrow, and aſcend up by the ſides of it, growing thicker as they go (but without being inſerted any where into the Marrow) till having enter'd the

Skull they are joined to the Fibres of the *par vagum* or eighth pair. Their progreſs from thence we obſerved in Chap. 13. when we deſcribed the eighth pair.

CHAP. XV.

Of the Nerves of the Vertebræ *of the* Thorax.

Twelve of the Thorax.

FROM the Marrow of the *Vertebræ* of the *Thorax* ſpring twelve pair. In all of which the formore branches are bigger; and the hinder which are beſtowed upon the Muſcles ſeated on the Back, ſmaller.

The firſt Pair.

The *firſt* pair ſpring out of the lateral holes which are common to the ſeventh *vertebra* of the Neck, and the firſt of the *Thorax*, and therefore 'tis indifferent whether they be eſteemed to belong to the Neck or *Thorax*, ſome reckoning them to be the eighth pair of the Neck, and others (as we do here) the firſt of the *Thorax*. Each Nerve is preſently divided (as all the reſt are) into two branches; the *formore* of which are united to the like branches of the ſixth and ſeventh of the Neck, as was noted in the fore-going *Chapter*, and ſo are all ſpent on the Arms, except one little twig that ſpringing out of the beginning of each marcheth forward towards the *Sternum*, and beſtoweth twigs on the *Muſculus ſubclavius*, and thoſe Muſcles which ariſe from the top of the *Sternum*; and another that goes to that Muſcle which fills up the hollowneſs of the Shoulder-blade. The *hinder* branches creeping under the

Muſcles which cleave to the *Vertebræ*, are beſtowed upon the Muſcles of the Neck, Head and Shoulder-blades.

The ſecond. The *ſecond* iſſue out of the holes between the firſt and ſecond *Vertebræ* of the *Thorax*, the *fore* branches whereof are united with the like of the firſt of the *Thorax*, and together with them are joined to the *fore* branches of the ſixth and ſeventh of the Neck, and theſe all together make one *Plexus* on each ſide (called Axillar) that ſendeth forth all the Nerves to the Arms that they have, (as ſhall be further explained, *Book* IV. *Chap.* 3.) But before the *fore* branches of this pair unite with the others, each ſends a twig alſo to the Intercoſtal Nerve (or ninth pair) deſcending down the *Thorax*, (as alſo does every one of the remaining ten pair) and from that twig before it join with the Intercoſtal there proceed ſmall ſlips to the Muſcles that lie upon the *Thorax*. The *hinder* branches have the ſame diſtribution with the hinder of the foregoing pair.

The reſt of the Pairs. The reſt of the ten pair come out of the lateral holes betwixt the *Vertebræ*, and are all immediately divided on each ſide into two branches; whereof the *formore* being larger, always ſend each of them one twig to the Intercoſtal Nerve, and the remainder of them is beſtowed on the Intercoſtal Muſcles internal and external, and on thoſe that lie on the *Thorax*; as alſo on the obliquely deſcending Muſcles of the *Abdomen*, &c. The *hinder* bend backward to the Spine, and are ſpent upon the Muſcles and Skin of the Back.

CHAP. XVI.

Of the Nerves of the Vertebræ *of the Loins.*

Five of the Loins.

OUT of the Marrow contained within the *Vertebræ* of the Loins, ariſe five pair of Nerves. The *fore* branches being greater go to the Muſcles of the Belly: The *hinder* to thoſe which reſt upon the *Vertebræ*. The *formore* (as *Spigelius* affirms) are joyned together, the firſt with the ſecond, the ſecond with the third, the third with the fourth, and the fourth with the fifth, as the two laſt of the Neck and two firſt of the *Thorax* were.

The firſt pair.

The *firſt* pair come out of the lateral holes between the laſt *Vertebra* of the *Thorax*, and the firſt of the Loins. The *fore* branches are beſtowed upon the fleſhy part of the Midriff, eſpecially its hinder proceſſes that are knit to the *Vertebræ* of the Loins, and on the Muſcles *Pſoæ*. Whence when there is a large ſtone in either Kidney, (the lower ends of the Kidneys reſting upon the heads of theſe Muſcles) this Nerve is compreſſed thereby, and from thence is a numneſs extended to the Thigh of that ſide, becauſe theſe Muſcles terminate in the Thighs. Theſe *fore* branches do each of them alſo ſend a twig along with the *Arteria præparans* to the Stone, according to *Spigelius*. From whence it is, partly, that too immoderate Venery cauſeth a weakneſs in the Loins. The *hinder* are beſtowed upon the *Muſculus longiſſimus* of the Back, *Sacrolumbus*, &c.

The ſecond.

The *ſecond* come out between the firſt and ſecond *Vertebræ* of the Loins, under the Muſcles

Pſoæ, (which are the firſt pair of thoſe that bend the Thighs.) The *formore* branches are beſtowed upon the ſecond pair of thoſe Muſcles that bend the Thighs, which fill up the cavities of *Oſſa Ilea*, and on the *Muſculi faſciales* and the Skin of the Thighs. The *hinder* are beſtowed upon the *Muſculi glutæi*, and the membranous pair of Muſcles which extend the Leg. Each of thoſe twigs which from this pair joyn with the Intercoſtal, goeth to the *Teſtis* of its own ſide (according to *Veſalius*, &c.)

The *third* paſs out of the holes between the ſecond and third *Vertebræ*, under the *Pſoæ* alſo. The *formore* branches each of them ſend one twig to the Knee and the Skin thereof, and another which doth accompany the *Saphœna* down the Leg. The *hinder* turn back, and are beſtowed upon the Muſcles which reſt upon the Loins. *The third.*

The *fourth* iſſue out between the third and fourth *Vertebræ* being the largeſt of the Nerves of the Loins, and marching under the *Pſoæ* and *Oſſa pubis*, accompany the Crural Veins and Arteries. *The fourth.*

The *fifth* come out between the fourth and fifth *Vertebræ*. The *fore* branches paſs through the holes that are between the bones of the *Coxendix*, *Pubes* and *Ileum*, (one on each ſide) and are beſtowed upon the *Obturatores Muſculi* of the Thigh, the Muſcles of the *Penis*, and on the neck of the Bladder, and of the Womb. The *hinder* are beſtowed upon the Muſcles and Skin which lie upon the *Vertebræ*. *The fifth.*

CHAP. XVII.

Of the Nerves which ariſe from the Marrow of Os ſacrum.

Six of Os ſacrum.

FROM the Marrow of *Os ſacrum* ſix pair of Nerves ſpring.

The firſt pair.

The *firſt* iſſue out between the laſt *Vertebra* of the Loins, and the firſt of *Os ſacrum*, in the ſame manner as thoſe that ſpring out of the *Vertebræ* of the Loins, and like them are each divided into two branches. The *fore* branches are a great part of them mixed with thoſe other of the Loins that go towards the Thighs, yet each ſends forth a twig that is diſpenſed to the Muſcles of the Belly, and to the ſecond bender of the Thigh. The *hinder* are beſtowed upon the Skin of the Buttocks, and the greateſt *Glutæi.*

Of the other five pair.

The other *five* pair ſpring after a different manner from the foregoing. For before they come out of the *Os ſacrum*, they are every of them double on each ſide; and ſo from each on either ſide there ariſe two Nerves, one of which is carried into the fore or inner, and the other into the hinder or outer ſide. The *three uppermoſt formore* Nerves go towards the Thighs, as the greateſt part of the firſt pair did: The *two lower* to the Muſcles of the *Anus* and Bladder; in Men to the *Penis*, in Women to the neck and *vagina* of the Womb, and ſo to the outward Privity. All the *five hinder* Nerves are diſtributed to the Muſcles of *Oſſa Ilea* and *ſacrum*, towards the back part, which are *Longiſſimi*, *Sacrolumbi*, *Sacri*, and the *Glutæi.*

How the *Brachial* and *Crural* Nerves are formed out of the Nerves of the Spine, ſhall be more particularly, but briefly ſhewn in the next Book.

And thus we have done with all the *thirty pair* of *Nerves* that ariſe out of the *Spinal marrow*, having ſhewn which way they paſs, and to what parts they are diſtributed : which ſhould be diligently noted, that we may the better know to what place to apply Remedies when from any outward Cauſe, as from a fall, bruiſe or the like, any part has loſt either ſenſe or motion, or both. For the Medicine is to be applyed always to the beginning or riſe of that Nerve that paſſes to that part, and not to the place in which the ſymptom appears. And the ſame thing is to be obſerved in Palſies, when the uſe of ſome particular Limb is taken away from an inward cauſe.

The Blood-veſſels of the Spinal marrow.

Having finiſhed our diſcourſe of the Veſſels that *ſpring from* the Spinal marrow, we will add a word to what was ſaid above, Ch. 8. of the *Blood-veſſels* that are *diſperſed through* it, from Dr. *Willis*. Theſe are of three ſorts, *Arteries*, *Sinus* and *Veins*. It is ſupplied with *Arteries* after one manner *above* the Heart, and after another *below* it. For *above* it, ſeeing the trunk of the *Aorta* is preſently cleft into many branches, which depart from the Spine, therefore from its Axillar branches there ſprings a *Vertebral Artery* on each ſide, which aſcending ſtreight to the *Occiput*, ſends a twig in at every joynting of the *Vertebræ* : But below the Heart, inaſmuch as the *Aorta* in its whole deſcent lies upon the Spine, there are received into the Spine two Arteries from its back ſide, betwixt every joynting of the *Vertebræ*. But both above and below, the Arterial branches that are carried toward the ſpine, being preſently divided each into two, one twig is beſtowed on the neighbouring Muſcles, and the other enters in at the joynting of the *Vertebræ*, within whoſe cavity it is ſubdivided into three other twigs, two of which are beſtowed on the *Medulla* (with its two Membranes) and the third on the Membrane that lines the inſide of the *Vertebræ* before. How theſe branches of Arteries inoſculate with one another, may better be conceived by the ſaid *Author*'s draught of them in his *Tab.* 13. than by a verbal deſcription, I therefore remit the Reader thither. The *Sinus*, he ſays, are continued from the lateral *Sinus* of the Brain, and all along the Spinal marrow they lie under the Arteries, having one Veſſel to receive the Blood from the Arteries and another to deliver it to the Veins, ſerving for the ſame uſes as thoſe of the Brain did, which were ſhewn above in Chap. 3. of this Book. Its *Veins*, like the Arteries, are communicated to it different ways *above*, and *below* the Heart. *Above*, a branch ariſing from the trunk of *Vena cava* below the ſubclavian, accompanies the Vertebral Artery up to the *Occiput*, ſending a twig in at every joynting of the *vertebræ*: but *below* the Heart, becauſe the trunk of *Vena cava* does not, like the *Aorta*, lie immediately upon the Spine, and ſo cannot immit twigs into it directly, therefore it ſends out of it ſelf *Vena ſine pari*, out of whoſe trunk two branches ſpringing, and each of thoſe being divided into two, one of them is beſtowed on the neighbouring Muſcles, and the other enters the Spine. Yet below the Kidneys, when there is lieve given to the *Vena cava* to be carried near the Spine, the *Vena ſine pari* ends, and the *vaſa Lumbaria* proceed immediately from the Trunk of the *Vena cava* as well as from the Trunk of the great Artery. The branchings of the *Sinus* and *Veins* within the Spine and their *anaſtomoſes* are curiouſly delineated in the aforeſaid *Tab.* 13. which deſerves to be conſulted by the Reader.

CHAP. XVIII.

Of the Face and its Parts.

IN the former *Chapters* we have diſcourſed of that part of the Head that is decked with Hair called *Calva*, of the Brain, &c. contained within it, of the *Medulla oblongata* ariſing out of it and prolonged into the *Medulla ſpinalis*, with the Nerves that ſpring out of the ſame both within the Skull and in the Spine, all which we have conſidered as Appendages to the Brain, ſeeing both the Marrow out of which they ariſe, ſprings out of it, and alſo all the Nerves have their Animal Spirits from it. Next we come to ſpeak of the ſmooth or unhairy Part, called *Facies*, the Face.

Now though all the parts of the Body ſufficiently ſhew the Wiſdom of the Creator; yet both the beauty of the Face, and its admirable conſent with the Mind doth epitomiſe as it were the comelineſs and dignity of all the other parts, and exhibits their affections as in a Glaſs. For from it are not only taken ſigns of health, diſeaſes, and imminent death; but alſo moſt clear tokens of the very diſpoſition, manners and affections of the Mind. For as ſhame and frightedneſs betray themſelves in the *Cheeks*; ſo do anger, joy, ſadneſs, hatred, and eſpecially love, in the *Eyes*. So from the *Forehead* are known ones gravity and humility; from the *Eyebrows* (or *Supercilia*) pride; from the *Noſe*, ſagacity or blockiſhneſs; *&c.* from the *motion* of the Face, wiſdom or fooliſhneſs, honeſty or wickedneſs, civility or incivility, good-will or hatred; from its *colour*, the temperament of the whole Body. Beſides, the ſex, the age, the ſtock, and one Man from another may be diſtinguiſhed by the Face.

The Parts of the Face.

The *Parts* of the Face are either *containing*, or *contained.*

The *containing* are *proper*, or *common.*

The *common* are ſufficiently deſcribed in *Book* I. *Chap.* 3. as not differing from the common integuments in other parts of the Body. Only here the *Membrana carnoſa* from the Eyes to the Chin is ſo thin that ſome have affirmed there is none: but in the Brows it is thicker, and cleaves very cloſe to the Skin.

The *proper* are the *Muſcles*, *Bones* and *Cartilages*, which ſhall each be deſcribed in their proper places.

The parts *contained* are the Eyes, Ears, Mouth and Noſe, and many beſides, which ſhall be treated of in the following *Chapters* of this *Book.*

The Face is divided into its *upper* and *lower* part. The *upper* is from the Hair of the Skull to the Eye-brows, and is called *Frons* the Forehead, which while the Body is entire belongs to the Face, but in a Skeleton to the Skull. This is not to be treated of here, as conſiſting of no proper parts but *Muſcles* and a *Bone*, which are to be deſcribed in their proper Books. The *lower* is extended from the Eye-brows to the Chin, and includes all the parts betwixt them; and to the deſcription of theſe we now proceed.

CHAP.

CHAP. XIX.

Of the Eyes in general, and their outward or containing Parts.

THE Eyes (in Latin *Oculi*, from *occludo* to ſhut, or *occulto* to hide, becauſe they lie hid under the Eye-lids) are the Organs of ſight, conſiſting of many ſimilar parts; and are as the two Luminaries of the Microcoſm, to afford us light; or like two Watchmen placed in the upper part of the Body as in a Watch-tower, to give notice of any approaching Danger.

Their Number.

They are in *Number* two, partly to make the ſight ſtronger; and partly that one being hurt, the other might perform the function of ſeeing in ſome meaſure, though more imperfectly.

Figure.

The Eye alone, diveſted of its Muſcles, is of a round or ſphærical *ſhape*, both that it might move the better in its orbit, and alſo that it might more conveniently receive the viſible Rays.

Colour.

The *Colour* of the Eyes in *Men* is ſometimes grey, ſometimes browniſh, ſometimes black: which variety is moſt conſpicuous about the *Pupilla* in the *Iris*, and proceeds from the colour of the *Uvea*. *Brutes* of the ſame ſpecies have not that diverſity of Colours.

Bigneſs.

Some have much larger Eyes than others; but thoſe which are largeſt and ſtand much out, have not ſo acute and piercing a ſight as thoſe that are leſs and ſtand further in.

Conſent.

There is great *Conſent* betwixt them, ſo that one being moved towards any Object, the other is moved towards the ſame. The Reaſon whereof we inquired before *Chap.* 11.

Light.

Some think they have a kind of congenit or inbred *Light*, without which they could not ſee; even as the Ears have a congenit Air within their Cavities, without which they could not hear.

Situation.

They are each *placed* in a large Cavity, called *Orbita* (or a Socket) on each ſide the Noſe, which is hollowed out of the bones of the Skull. And theſe orbits are inveſted on their inſide with the *Pericranium*, to which the fat and origins of the Muſcles cleave firmly. Theſe may be reckoned the firſt *containing* parts of the Eye; as may alſo, in the ſecond place,

The Eye-lids.

The *Palpebræ* or *Eye-lids*, which ſerve as Curtains to the Eyes, by which duſt and troubleſome ſmokes and vapours, too much light and the injuries of the Air are kept out, and the outward tunicle of the Eye called *Adnata*, but eſpecially that called *Cornea*, which covereth the *Iris* and *Pupilla*, is moiſten'd, wip'd and clean'd. They conſiſt outwardly of a very thin Skin which has no fat under it; inwardly they are lined with the *Pericranium*, that is here moſt thin and ſmooth. Betwixt theſe parts comes the *Membrana carnoſa*, which is alſo very thin. Each Eye has two. In Man the lower is leſs, and is but very obſcurely moved in compariſon with the upper: but in Birds the lower is the larger, and in moſt ſeems only to be moved, the upper remaining unmoveable. *Steno* mentions ſeveral *punčta lachrymalia* in their inner Membrane, which run on each ſide into one Duct, (called by him *Cilliciæ*) whereby the ſuperfluous moiſture of the Eye-lids is conveyed into the Noſtrils. At their edges they have little ſoft Cartilages, (called *Cilia* in Latine) to ſtrengthen them, and that they may meet the more ex- [illegible] Upon theſe Cartilages there grow Hairs,

Cilia.

which having attained to a certain length, will naturally grow no longer, ſo that they never need to be cut. Thoſe on the upper Eye-lid turn ſomething upwards, and thoſe on the lower downwards. Above the upper Eye-lid grow alſo a Sett of Hairs, betwixt it and the Fore-head, out of the *Supercilia* or Eye-brows; theſe lie pretty flat bending from within outwards, and hinder ſweat from the Brow, duſt or other things from falling into the Eyes.

Supercilia.

Canthi. *Their Glands.*

Whence Tears proceed.

The Eye-lids have two corners called *Canthi.* The *outer* of theſe is leſs, and in its upper part it has a Gland placed (uſually called *Innominata*, or nameleſs, but might be named *lachrymalis*, as affording the moſt of that *Lympha* that makes the Tears.) This Gland is conglomerate, being made up of many leſſer, and has ſmall twigs of Arteries that creep to it, and depoſite *Serum* or *Lympha* in it to ſupply matter for *Tears* upon occaſion. But the ordinary uſe of this *Lympha* is to moiſten the inſide of the Eye-lids, and the Superficies of the Eyes, that they may move more glibly. *Steno* has obſerved that in a Calf the fore-part of this Gland is elegantly divided into Lobes (being indented on its edge) and that betwixt the intervals of theſe there paſs out excretory Veſſels from the Gland, which running forward within the inner coat of the Eye-lid make little holes in it at a little diſtance from the *Cilia*, thro' which they diſcharge their humour. And he doubts not but there are ſuch Veſſels in Men, in whom he calls them *vaſa lachrymalia.* *Diemerbroeck* having reckoned eight opinions concerning the cauſe, origin and matter of tears, rejects them all, and this we have mention'd with the reſt: and thinks that their matter is the more ſerous and thin particles of the pituitous humour collected in the Brain, and flowing to the Eyes upon its contraction, through the *Foramen lachrymale* ſeated at the inner corner of the Eye. Which the Reader may ſee defended in his *Anat. lib.* 3.*cap.* 15. There is another ſpongy and ſoft Gland in the inner *Canthus* or Corner; ſeated upon the *Foramen lachrymale*, which helps the former in its office, but is not above a third part ſo big. Dr. *Briggs* ſays, there are two or three lymphatick Veſſels that receive *Lympha* from it, and end in the inſide of the Eye-lid; and that eight ariſe out of the former Gland, and end in the *Tunica adnata*, where they continually depoſite ſomething of *Lympha*, to keep the Eye moiſt. *Nerves* come to them from the *fifth* pair, which communicating with the *Intercoſtal*, are much irritated in the paſſions of ſudden joy or of ſadneſs, and ſo twitch and compreſs theſe Glands that the *Lympha* is ſqueezed or milked as it were out of them, as Dr. *Willis* ingeniouſly ſuppoſes. *Steno* thinks, that in weeping, the flux of tears is principally owing to the contraction of the capillary Veins, by which means the blood and *ſerum* cannot be ſo quickly carried back from theſe Glands as they are brought to them by the Arteries, and therefore the *ſerum* ouzes out (as blood has alſo been obſerved to do ſometimes.) Which Opinion differs not much from Dr. *Willis*'s, if we will ſuppoſe the contraction of the Veins to be owing to the Nerves, as it is reaſonable we ſhould.

As for the *Muſcles* of the Eye, they ſhall be deſcribed in the Fifth Book.

CHAP.

CHAP. XX.

Of the Tunicles of the Eye.

HAving done with the outward or *containing parts* of the Eye, we come now to the *Eye* it ſelf, and firſt of its *Tunicles.*

The Tunicles of the Eye, one common,

The outmoſt *Tunicle* of the Eye is *common*, and is called *Adnata.* It ſprings from the *Pericranium*, and is ſpread over all the White of the Eye above the *Sclerotica*, reaching as far as the *Iris.* By this the Eye is kept firmly within its orbit, from whence it is alſo called *conjunctiva.* It is of very exquiſite ſenſe, and has many capillary Veins and Arteries creeping through it,which are moſt conſpicuous in an Ophthalmy or inflammation of the Eyes. Under this Tunicle are the Tendons of the Muſcles extended and expanded to the circumference of the *Iris*, which increaſe its whiteneſs; and ſome take them for a ſecond Tunicle, calling it *Innominata.*

Three proper.
1. Sclerotica.

The *proper* Tunicles of the Eye are three, according to the threefold ſubſtance of the Optick Nerve. For this Nerve (as all the other) conſiſts of two Tunicles ſpringing from the *Dura* and *Pia Mater*, and an inner marrowy ſubſtance. From the *Dura Mater* ſpringeth the outmoſt coat of the Nerve, and from this the Tunicle that is ſpread next under the *Adnata*, called *Sclerotica* from its hardneſs; but in its forepart where it covereth the *Iris* and *Pupilla*, it is named *Cornea*, from its tranſparency; though ſometimes this latter name includes the whole Tunicle, as well behind and on the ſides,as before.

2. Choroides. That which lieth next under the *Cornea* is much thinner than it, and is called *Choroïdes*, from its reſembling the Membrane *Chorion* wherein the *Fœtus* is included in the Womb. Its fore-part is otherwiſe called *Uvea*, becauſe it is ſomewhat of the colour of a Grape. This ſprings from the *Pia Mater*, and is ſpread from the bottom or centre of the Eye behind, all over the Eye to the *Pupilla*; to whoſe circumference when it is come, it becomes double, making with one part the *Iris*, with the other the *Ligamentum ciliare*. On the inſide it is of a duskiſh colour, (in Man) but blacker on the outſide. But where it makes the *Iris*, it is of divers colours reſembling the Rainbow, from whence it borrows its name: yet in ſome it is more blue, in others black, in others grey. This Tunicle is perforated before as wide as the *Pupilla* (or ſight of the Eye) to permit the rays of viſible ſpecies to paſs in to the cryſtalline humour. Next unto which cryſtalline humour lies the *Ligamentum ciliare*, the ſecond part of the duplicated *Uvea*. This conſiſts of ſlender Filaments or Fibres, (like the Hairs of the Eye-lids) running like ſo many black lines from the circumference of the *Uvea* to the ſides of the cryſtalline humour, which they encompaſs, and widen or conſtringe as there is occaſion, by contracting or opening the *Foramen* of the *Uvea*.

3. Retiformis. *This the principal organ of ſight.* The third Tunicle is made of the medullar ſubſtance of the Optick Nerve, and is called *Retina* or *Retiformis* (Net-like:) This ſeemeth to be the principal Organ of Sight. For, as Dr. *Briggs* well argues, neither the cryſtalline humour, through which the rays paſs much refracted; nor the Tunicle *Choroïdes*, are at all fit for this uſe. For this latter part (as ariſing from the *Pia Mater*)

cannot communicate the impreſſions of the rays to the medullar part of the Brain, which it does not at all touch. Whereas the medullar Fibres of the *Retina* have communication therewith, as ſpringing therefrom, and therefore can well perform that office. The Fibres of this Tunicle are extended from the bottom or inner centre of the Eye, where the Optick Nerve enters it, as far as the *Ligamentum ciliare*, (to which it affords Animal Spirits for the continuance of its motion.) If one take this *Tunica Retina* and put it into warm water, ſhaking it a little, to waſh off the mucous ſubſtance that cleaves to it, and then hold it up to the light, theſe Filaments will appear very numerous like the threads of the fineſt Lawn.

CHAP. XXI.

Of the Humours and Veſſels of the Eye.

The humours of the Eye three.

NExt to the Tunicles of the Eyes are the *Humours* contained in them to be conſidered. And theſe are in number three, *viz. Aqueus*, *Cryſtallinus*, and *Vitreus*. The ſecond weighs as much again as the firſt, and yet not ſo much as the third by a ſixth part. The Cryſtalline is the moſt denſe of conſiſtence by much; and the glaſſie more denſe than the watry.

1. Aqueus.

The *Aqueous* humour is outermoſt, being pellucid and of no colour (as neither are the other two.) It fills up that ſpace that is betwixt the *Cornea* and the Cryſtalline humour before. If any thickiſh particles ſwim in it, then Gnats, Flies, Spiders webs and the like will ſeem to be flying before the Eyes. But if thoſe particles grow ſtill thicker, and cloſe together ſo as to make a film, and this be ſpread before the hole of the *Pupilla*, then is the ſight quite taken away, which diſeaſe is called a *Cataract.* This Humour is very clear, and thin, and therefore eaſily diſſipable; but by which way its expence ſhould be ſupplied, is difficult to determine. Some think it is fed by the Arteries out of which this water iſſues through I know not what Glands; others derive it from the Nerves, and a third ſort from the Lympheducts. But Dr. *Ant. Nuck* refutes all theſe Opinions; the firſt from the non-appearance of any Glands; the ſecond, from the no (or at the moſt a very ſmall quantity of) liquor that at any time can be obſerved in the Nerves: whereas if the *tunica cornea* be prick'd, and all or the greateſt part of this aqueous humour be let out, he has found by repeated Experiments that it will be recruited again in ſix hours ſpace. The third Opinion he refutes from the general office of Lympheducts, which is, to bring back from the circumference to the centre, and not contrarily, becauſe the valves wherewith they every where abound cannot admit of that motion. Wherefore exploding all theſe Opinions, he eſtabliſhes a new one of his own, upon the ſcore of the new Veſſels that he has obſerved to terminate in the *tunica cornea*, (which he calls *ductus oculorum aquoſi*, which we ſhall deſcribe from him by and by) affirming, that theſe Ducts are the Conduits by which this humour is fed, and that they ſupply it ordinarily with ſeveral drops daily, becauſe of the continual tranſpiration of it by pores looking from within outwards. As to the particles of this Humour, from ſeveral Experiments he has made, he thinks it is demonſtrable; 1. that it contains in it a very limpid and pellucid water. 2. Viſcid and tenacious particles. 3. A ſalt and an acid. 4. Earthy particles. 5. That it wants not alſo its volatil ſpirit.

2. Cryſtallinus.

The *Cryſtalline* humour (ſo called from its being as clearly tranſparent as Cryſtal) is placed betwixt the aqueous and the vitreous, but not exactly in the middle or centre of the Eye, but rather towards its fore-part. It is incloſed in the boſom as it were of the vitreous humour, and is flattiſh on the foreſide, but rounder behind. It is more bright and ſolid than either of the other two. It has been the common Opinion that it is incloſed in its proper Membrane, which is called either *Cryſtallina* from its tranſparency, or *Aranea* from its moſt fine contexture. But Dr. *Briggs*, a very accurate Anatomizer of the Eye, denies any ſuch Tunicle, affirming that it is meerly adventitious when the humour is expoſed for ſome while to the Air, or is gently boiled. As to the collection or reception of the rays of things viſible, this humour is the primary inſtrument of ſight: though as was ſaid before, the *tunica retina* is the principal as to perception, becauſe through it the rays are communicated to the common ſenſory.

3. Vitreus.

The third and laſt Humour of the Eye is the *Vitreous*, ſo called becauſe it is like to molten Glaſs. This is the thicker than the Aqueous, but thinner than the Cryſtalline; and much exceeds them both in quantity, for it fills up all the inner or hinder hemiſphere of the globe of the Eye, and a pretty deal (toward the lateral ſuperficies) of the formore. It is round behind, but hollowed in the middle forwards, to receive the Cry- [illegible] ſtalline into its boſom. This humour is alſo ſaid to be ſeparated from the other two by a proper Tunicle called *Vitrea*, which the aforeſaid ingenious Author likewiſe denies.

See the Situation of theſe Humours repreſented in *Fig.* II. of *Tab.* 14. inſerted *p.* 415.

The Veſſels of the Eye. The Eyes have *Arteries* from the *Carotides*, which beſtow twigs on their Muſcles, and on their Tunicles. And theſe are accompanied with *Veins* ſpringing from the Branches of the Jugulars. As for their *Nerves*, they either aſſiſt the ſenſe of ſeeing, and are called the Optick Nerves, which we have reckoned for the ſecond pair and deſcribed before *Chap.* 10. or ſerve for the moving of them, being inſerted into their Muſcles, and to this purpoſe ſerve the third and fourth pair, and ſome twigs of the fifth. As to their *Lympheducts*, we have ſpoken of them above, *Chap.* 19. when we diſcourſed of the Glands placed at each *Canthus* or Corner of the Eye-lids. Beſides theſe Veſſels, Dr. *Ant. Nuck*, whom we cited but juſt now, has diſcovered a fifth ſort of Veſſel, called by him *ductus oculorum aquoſi*, which he believes do recruit the continual conſumption of the watry humour of the Eye. He ſays they are of an uncertain number, and may be plainly diſcerned to run along the *tunica ſclerotica*, and to penetrate at length the *cornea*, where their Orifices have ſuch a Valve as the Ureters have in the Urinary Bladder, or the *porus bilarius* in the *veſica fellea*. In the *tunica ſclerotica* and *cornea* they are of a dusky colour, but not before they arrive thereat. They admit of a Probe of a pretty bigneſs, and are of a ſtronger make than Lympheducts. He has taken great pains to trace them to their Origine, but has not yet been able to follow them further than to the Optick Nerve. So that he knows not whether their Riſe may be from ſome Gland not yet diſcovered, or whether the *Glandula pituitaria* may not ſend forth ſome ſhoots that conſtitute theſe Ducts.

The Action of the Eyes.

The *Action* of the Eyes is *Viſion*. Which is very well defined by *Diemerbroeck. viz.* That it is *a ſenſe, whereby, from the various motion of viſible Rayes collected in the cryſtalline and vitreous humours, and darting upon the* tunica retina, *the Colours of viſible Objects are perceived, with their ſite, diſtance, greatneſs, figure and number*;] the *medium* of which perception is the light. But we ſhall not enter upon a diſcourſe of Viſion here, as being more proper for a Philoſopher than an Anatomiſt.

CHAP. XXII.

Of the Auricula.

The Ears.

AS the *Eyes* are placed in the upper part of the Body like two Watchmen to deſcry approaching danger; ſo are the *Ears* there ſeated alſo, that they might give information of what the Eyes cannot diſcover either in the night for want of light, or through the interpoſition of ſome thick and opaque Body which the Sight cannot penetrate. And as the Eyes contemplate the wonderful Works of God, whereby the Mind may conceive of his Infinity; ſo the Ears are the Inlets or Receivers of Verbal Inſtruction in all Wiſdom and Science. For they are the Organs of Hearing, and are in Number two, that the one failing, yet we might hear with the other. They are placed in the Head, becauſe Sounds aſcend.

Their Parts. Auricula. The *Parts* of the Ear are either *outward* or *inward.* The *outward* is called *Auricula*, which is onely an adjuvant Inſtrument of Hearing, being ſpread like a Van to gather and receive the ſounds. *The Names of its Parts.* Its upper part is called *Ala* or *Pinna* the Wing; and its lower and ſoft Lobe, uſually *Infima Auricula.* It has ſeveral protuberances or eminences, and cavities. Its outmoſt *protuberance* that makes its circumference, from its winding is called *Helix*; and that which is oppoſite to it, *Anthelix*: but that next the Temple, becauſe in ſome it is hairy, is called *Hircus* or *Tragus*; and that which is oppoſite to it, to which the ſoft Lobe of the Ear is annexed, *Antitragus*, which likewiſe in ſome is hairy. Its *Cavities* are three. The inmoſt, becauſe of the yellow Ear-wax (as we call it) that is gathered in it, is named *Alvearium*; as alſo *Meatus Auditorius*; (of which more in the next Chapter.) The next to this outwards which is bigger, from its tortuoſity or winding is called *Concha.* The third is that betwixt the *Helix* and *Anthelix*, which has had no Name impoſed on it.

Its conſtituent Parts. The *conſtituent Parts* of the *Auricula* are either *common* or *proper.* The *common* are *Cuticula*, *Cutis*, and *Fat* in the Lobe. The *proper* are the *Muſcles*, *Veins*, *Arteries*, *Nerves*, the *Cartilage*, and a *nervous Membrane* or Tegument which immediately embraces the whole Cartilage, which ſome reckon to the *common* Parts. As concerning the *Muſcles*, they are ſet down in their proper Treatiſe. The *Veins* come from the external Jugulars; the *Arteries* from the *Carotides*; the *Nerves* from the ſecond Pair of the Neck, being joined with the harder proceſs of the ſeventh Pair. As for the *Cartilage*, it is a ſubſtance that is fitteſt for this place. For if the Auricle had been bony, it might by many Accidents have been broken off; or if it had been fleſhy or onely membranous, it would not have ſtood ſo ſpreading, but have flapt down. Whereas a Cartilage is not in danger of breaking, and yet it is ſtiff enough to keep this outer part of the Ear expanded. It is tied to *Os petroſum* by a ſtrong Ligament which riſeth from the *Pericranium.*

Uſes. The *Uſes* of the *outward* Ear or *Auricle* are theſe: Firſt, it ſerveth for Beauty. Secondly, it helps the receiving of the Sounds. For firſt, it gathereth them being diſperſed in the Air. Secondly, it doth moderate their *Impetus*, ſo that they come gently to the *Tympanum.* Such as have it cut off upon any occaſion, are very much prejudic'd in their Hearing, which becomes confuſed with a certain murmur or ſwooing like the Fall of waters.

Parotides. Both behind and below each Ear, there are ſeveral Glands outwardly under the Skin, that are called *Parotides.* But there are two more notable than the reſt, near one another; of which one is leſſer, and is *conglobate*; but the other bigger, conſiſting as it were of many leſſer, and is *conglomerate.* From the *conglobate*, according to *Steno*, there ariſe Lympheducts, returning the *lympha* that is ſeparated in them into the Jugular Veins; and in the *conglomerate* the *ſaliva* is ſeparated, which is conveyed into the Mouth by proper Ducts: but of theſe more by and by, in Chapter 26.

CHAP. XXIII.

Of the inward Part of the Ear.

THE inward Part of the Ear is that which we properly call *Auris*, and begins at the *Meatus Auditorius*, or that inmoſt Cavity of the Auricle in which the Ear-wax is collected. This Cavity aſcends ſomething with a winding Duct, that the vehement *Impetus* of Sounds may be a little infringed before they vibrate upon the *Tympanum*. Monſ. *du Verney* (that has lately writ a particular Treatiſe of the Ear) ſays, that this *meatus* or tube that reaches from the *Concha* to the *Tympanum*, conſiſts partly of a Cartilage, and partly of a Bone. The Skin that covers it, he ſays, is furniſhed with an infinite number of Glandules of a yellowiſh colour, each of which has its Tube opening into this *Meatus*, by which they ſend that yellow glewy ſubſtance which is ordinarily found in it, and hinders Inſects from creeping into the Ear, entangling them like Bird-lime.

Meatus Auditorius.

The Ear-wax.

The Tympanum.

Before its inner end is ſpread the *Tympanum* or Drum, which is a nervous, almoſt round and pellucid Membrane, of moſt exquiſite ſenſe, dividing the *outward* from the *inner* Ear. Some will have it to ſpring from the *Pericranium*, others from the *Pia Mater*, a third ſort from the *Dura Mater*, a fourth from the ſofter proceſs of the Auditory Nerve expanded. And laſtly, ſome think that it has a proper ſubſtance, ſpringing from no other Membrane, but made in the firſt formation of the parts. It is very dry, that it might give the better ſound. It is ſtrong, that it ſhould the better endure external Harms. It is inchaſed in a chanel or rift made in the circumference of the outer end of the Bone that joins to the Cartilage which forms the largeſt part of the *Meatus*, and it has a Cord that runs croſs it behind, which ſome take for a Ligament to ſtrengthen it; but *du Verney* ſays it is a branch of the ſeventh pair of Nerves, which ſupplies twigs to the Muſcles that move the *Tympanum*; (for it hath two *Muſcles* to move it, which ſhall be deſcribed in the Fifth Book, Chap. 8.)

The firſt Cavity.

When it is taken away, there appears a *Cavity* on the inſide of it, which by ſome is alſo called *Tympanum*, but by *du Verney*, the *Barrel*. Who ſays, it is a quarter of an inch long and half an inch wide. It is encompaſſed round with Bone, and clad within with a Membrane that is interwoven with a great number of Veſſels.

Its four little Bones.

In this Cavity are contained *four* little *Bones* that are moveable, and conduce much to hearing. They have no Marrow in them, nor are covered with any Membrane or *Perioſteum*, yet at their extremities where they are joyned, they are bound with a ſmall Ligament one to another. And they have this alſo peculiar to themſelves, that they are as big in Infants as in grown perſons, as are alſo the Bones of the *Labyrinth* and *Cochlea*, according to *Veſlingius* and *du Verney*.

1. Malleolus.

The *firſt* is called *Malleolus*, the little Hammer. It hath a round Head, which is inarticulated into the Cavity of the Anvil by a looſe Ligament. This Head is continued into a ſmall Neck or Handle, which reaching beyond the middle of the *Tympanum*, adhereth to it. About the middle it hath two proceſſes: The one of which, being ſhorter but thicker, has the Tendon of the internal Muſcle inſerted into it; and the other being longer but ſmaller, the Tendon of the external, whereby this Bone immediately, but mediately the *Tympanum* is moved, as ſhall be further explained in the aforeſaid *Chapter* of the Fifth Book. And ſee *Tab.* 15. before-going wherein all theſe four Bones with the Muſcles are repreſented.

2. Incus. The *ſecond* is called *Incus*, the Anvil, having one Head, and two Feet, being ſomewhat like one of the grinding or double Teeth that has two roots, onely one of its Feet is conſiderably longer than the other. The Head is pretty maſſie, having in the top of it a little ſmooth cavity, which receiveth the knob or head of the Hammer. The ſmalleſt (but longeſt) Foot is tied to the top or head of the Stirrop by a looſe but firm Ligament; but the thickeſt, broadeſt and ſhorteſt reſteth upon the *Os ſquamoſum.*

3. Stapes. The *third* is *Stapes*, or the Stirrop. This is not ſo compact and ſolid as the two former, but more porous. In Figure it is almoſt triangular, in the middle hollow, to give way to the paſſing of the Air to the *Labyrinth.* In the upper part of it is a very ſmall and round knob, upon which the longeſt foot of the Anvil reſteth. Its Shape is much adapted to the *Feneſtra ovalis* (which opens into the Labyrinth) about which it is tied round ſomewhat looſely, ſo that it may be driven to within its *Sinus*, but cannot without violence be pulled outwards.

Os orbiculare. The *fourth* Bone was found out by *Franc. Sylvius*, and from its round ſhape is called *Orbiculare.* It is tied by a ſlender Ligament to the ſide of the *Stapes*, where the *Stapes* is joined to the *Incus. Du Verney* ſays, that this Bone comes betwixt the long foot of the Anvil and the knob or head of the Stirrop: And that on that ſide next the Head of the Stirrop it is convex, being received into a little Cavity of the ſaid Head; and on that ſide next the Foot of the Anvil it is a little hollow, receiving the ſaid Foot into it ſelf.

Two Chanels.

From the lower ſide of this *firſt inner* Cavity, wherein theſe Bones are contained, there is a round *Meatus* or Chanel to the Palate of the Mouth near the root of the *Uvula*; and another from its upper ſide that runs to the cavity of the Noſtril, as has formerly been taught; but the aforeſaid Author deſcribing it to be much wider but a great deal ſhorter than the other, ſays, That it penetrates to within the ſinuoſities of the mammillary proceſs of the Temple-bone. Thoſe who thought it to run to the Noſtrils, ſuppoſed it to convey thither pituitous Matter collected within this firſt Cavity; but *du Verney* thinks its uſe to be, to permit the internal Air to retire into the ſinuoſities of the aforeſaid proceſs when the *Tympanum* is driven inwards by the external Air, and that the internal Air returns from thence again upon the relaxation of the *Tympanum*. And as to the former chanel, he calls it an *Aqueduct*, and ſays, that its firſt and ſhorter part is bony, but the ſecond and longer partly cartilaginous and partly membranous, which part paſſing near the root of the Noſe is lined with a glandulous skin that is a continuation of that which cloaths the inſide of the Noſtrils. So that he believes, that part of the Air which is drawn in at the Noſe penetrates this chanel (and ſo may aſcend to the Ear) and on the contrary thinks that aqueous humours deſcend by it into the mouth by its aperture in the Palate, for he denies that there is any Valve in it which might ſtop any thing from paſſing either way. Other

Authors (not denying this latter uſe, but not ſuppoſing that it had any communication with the Noſtrils; inſtead of the former uſe derived from thence) have thought, that air and alſo ſounds might paſs through it in at the *Mouth* to the Ear, by obſerving that thoſe who are thick of hearing do uſually hold their mouths open when they liſten attentively, which they do probably becauſe they are partly aſſiſted thereby in their hearing.

Two holes. In the middle alſo of this cavity oppoſite to the *tympanum*, in the *os petroſum* there are two holes, the greater and higher of which is ſhut by the baſis of the *Stapes* (when no ſounds affect the Ear) and is of an oval figure, whence it is called *Feneſtra ovalis*, and opens inwards or backwards pretty wide into the Labyrinth. The other is leſs and lower, and is of a round ſhape, whence it is called *Rotunda.* The Orifice of this is open, but within the middle of its chanel it has a rift wherein is inchaſed a thin, dry and tranſparent Membrane like that of the *tympanum.* Behind which it is divided into two Pipes divided by the *Os ſquamoſum*, one of which tends to the *Cochlea*, the other to the Labyrinth.

Feneſtra ovalis.

Rotunda.

The ſecond Cavity or Labyrinth. This *Labyrinth* is the *ſecond inner* cavity, being far leſs than the former, and was firſt ſo called by *Falopius*, from the hollowed bony ſemicircles (cloathed with a thin membrane) returning circularly into the ſame cavity. The *Feneſtra ovalis* and *rotunda* open into it out of the firſt cavity: and beſides theſe holes it has five others, one of which opens into the end of the larger *Gyrus* or winding of the *Cochlea*; The other four are ſo ſmall that they hardly admit an hair, through which the moſt ſlender Fibres of the auditory

Nerve proceed to the inner membrane that encompaſſes this cavity.

The third Cavity called Cochlea.

The *third* and laſt *inner* cavity is called *Cochlea*, becauſe in its ſpiral winding it reſembles a Snail's Shell. It is leſs than the Labyrinth, and has two, ſometimes three or four ſpiral windings, which are cloathed inwardly with a moſt thin Membrane, into which, as into the Labyrinth, the ſlender Fibres of the auditory Nerve enter, through three or four very ſmall holes.

Du Verney makes but two *inner cavities, viz.* the *Barrel* (which we deſcribed above) and the *Labyrinth*. But then he divides the Labyrinth into three parts: the foremoſt of which he calls the *Veſtibulum* or Entrance; the ſecond comprehends the three ſemicircular conduits or chanels, which (he ſays) are on that ſide of the Veſtible which is towards the hinder part of the Head; and the third is the *Cochlea*, which is on the other ſide. But this new diſtinction is of leſs moment, and therefore I paſs it over. As for the ſhape of the *Labyrinth* and *Cochlea*, it is ſhewn before in *Tab.* 15. But they are repreſented much larger than according to nature, as are alſo the Bones in the firſt cavity, that their parts might appear more plainly.

The congenit Air.

Theſe three inner Cavities are all formed within the *Proceſſus petroſus* of the Temple-bone, and in them is contained a moſt pure and ſubtile *Air*, which ſome think to be included in them in the very firſt formation of the parts, and therefore call it *Aer Inſitus* and *Congenitus*. Some ſuppoſe it to be Animal ſpirit, effuſed into them by the auditory Nerve.

The veſſels of the Ear.

This inner part of the Ear has *Veins*, *Arteries*, and *Nerves* from the ſame origines as the outer:

only the *harder* proceſs of the auditory Nerve goes to the *outer*, and the *ſofter* to this *inner*, which coming by the hinder *Meatus* of the *Os petroſum* is inſerted into and diſperſed through the circles of the *Cochlea* and Labyrinth.

Hearing what, and how performed.

All the parts of the *Auricula* and *Auris* concur to the perfecting the *Hearing*, which is a *Senſe whereby ſound is perceived from the various trembling motion of the external Air, beating upon the* Tympanum, *and thereby moving the internal Air with the Fibres of the auditory Nerve, and communicated to the common Senſory.* Now *Sound* that is the object of it, is nothing elſe but a quality ariſing from the Air or Water beat upon and broken by the ſudden and vehement concuſſion of ſolid Bodies. And the diverſity or greatneſs of ſuch ſound is diſtinguiſhed by the four Bones that ſtand on the inſide the *Tympanum:* For as from the greater or leſs, gentle or harſh impulſes of the external ſonorous Air (fluctuating like Waves cauſed by a Stone thrown into the Water) the Membrane of the *Tympanum* is accordingly driven or ſhak'd againſt the *Malleus*, the *Malleus* againſt the *Incus*, and the *Incus* againſt the *Stapes* ; ſo, as the ſame *Stapes* and *Os orbiculare* open the *Feneſtra ovalis* more or leſs, is there a freer or ſtraiter paſſage granted to the internal Air out of the firſt inner cavity into the Labyrinth and *Cochlea*, in whoſe tortuous and unequal windings it is variouſly infringed and modulated, from whence the *ſpecies* of ſound that is made thereby, (according to the diverſity of the external impellent) is ſometimes more acute, ſometimes more full, ſometimes more harſh, ſometimes more gentle, ſometimes bigger, ſometimes leſs : the *Idea* of which *Species* is carried to the common Senſory, (and ſo repreſented to the mind) by the auditory Nerve that expands it ſelf through the Membrane that inveſts the ſaid Labyrinth and *Cochlea.*

CHAP. XXIV.

Of the Noſe.

The Noſe.

THE Organs of *Seeing* and *Hearing* being deſcribed in the foregoing Chapters, we come now to the inſtrument of the third Senſe, *viz.* *Smelling*, which is the *Noſe*.

Its external parts, viz.

The parts of the *Noſe* may be diſtinguiſhed into the more *external* and the more *internal.* The more *external* parts are theſe, the Cuticle and Skin, Muſcles, Veins, Arteries, Nerves, Lymphe-ducts, a proper Duct, Bones and Cartilages. Firſt, the *Skin* cleaveth ſo faſt to the Muſcles and Cartilages, that it cannot be ſevered without renting. Secondly, as for the *Muſcles*, they are ſet down in the deſcription of the Muſcles, Book V. Thirdly, the *Veins* come from the external Jugulars, as the *Arteries* from the *Carotides.* Fourthly, the *Nerves* ſpring from the fifth pair. Fifthly, *Steno* has obſerved in Sheep and Dogs a *Lymphatick* Veſſel in each Noſtril; and 'tis probable there are the ſame in men. Sixthly, Both *Steno* and Dr. *Needham* deſcribe a *Meatus* or Duct, having two *foramina* in the *canthus* of the Eye, but opens but by one into the Noſe: and Dr. *Needham* has obſerved another paſſage going out of the middle of this, toward the Palate. By which Ducts any one may perceive that in weeping a great quantity of water doth flow from the Eyes.

Skin.

Muſcles.

Veins, Arteries and Nerves.

Bones. Seventhly, the *Bones* are deſcribed in Book VI. *Cartilages.* Chap. 6. Eighthly, the *Cartilages* are in number five; the two *upper* are broader, and adhere to the lower ſide of the Bones of the Noſe where they are broader and rough, and being joyned to one another paſs from thence to the tip of the Noſe, making up one half of the *Alæ*: the two *under* make up the other half, being joyned to the upper by a membranous ligament; the fifth divideth the Noſtrils. Theſe Cartilages are moved by the Muſcles.

Its inner parts. *A glandulous Membrane.* The *inner* parts of the Noſe are theſe: Firſt, the Membrane which covereth its inſide, which ſome think proceedeth from the *Dura Mater*, paſſing through the holes of the *Os cribriforme* with the nervous Fibres. This Membrane on its back ſide hath abundance of little *Papillæ* or Glands; in which the *Serum* or Rheum is ſeparated that runs out by the Noſe, (though *Diemerbroeck* thinks them to be the true Organ of Smelling.) *Hair.* Secondly, the *Hairs*, called in Latine *Vibriſſi*, which hinder the entrance of Inſects and of duſt in a great meaſure, as one draws his breath in at his Noſe. *Spongie fleſh.* Thirdly, the red fleſhy ſpongious ſubſtance, with which the holes of the *Os ſpongioſum* in the upper ſide of the Noſtril are filled up; from which the *Polypus* ſpringeth.

Length. The *length* of a comely Noſe is the third part of the length of the Face.

The denomination of its parts. The upper part of the Noſe which is bony, is called *Dorſum Naſi*, or the ridge. The lower lateral parts *Alæ* or *Pinnæ*. The tip of the Noſe, *Globulus*, and *Orbiculus*. The middle cartilaginous partition, *Septum*; and the fleſhy part, that at the bottom of the *Septum* reaches from the tip of the Noſe to the root of the upper Lip, *Columna*, *na.* The two holes that are cauſed by the partition, are called *Nares* the Noſtrils. And theſe about their middle are each divided into two, one of which goes up to the *Os cribriforme*, to convey ſcents thither: the other deſcends down upon the Palate to the *Fauces*, by which Rheum falls down either of its own accord if it be very thin; or by ſnuffing the Air up ſtrongly in at one's Noſe, if it be thick, which we may hawk and ſpit out at pleaſure.

Its uſes. The *Noſe* is an *external adjuvant* organ of ſmelling, as the *Auricula* is of Hearing. For when ſmells exhale out of odoriferous bodies into the air, by taking our breath in at the Noſe, the ſcents accompanying the air aſcend up the Noſtrils to the top of their Cavity, *viz.* to the *Os cribriforme*, through whoſe holes the olfactory Nerves (otherwiſe called *proceſſus mammillares*) iſſue out by their Fibres, and are diſperſed through the Membrane that cloaths the inſide of the Noſtrils, eſpecially its upper part: which Nerves, Fibres and Membrane are the *inward* immediate and *adequate* organ of Smelling. Other inferiour *uſes* the Noſe has alſo; as firſt, ſometimes to take in our breath by, that we may not keep our Mouth always open for that purpoſe. Secondly, to help the Speech, which is very much impaired by the loſs of it. Thirdly, it ſerves for the ſeparation and diſcharge of the mucous humours in the Blood.

CHAP.

CHAP. XXV.

Of the external parts of the Mouth.

The outer parts of the Mouth.

THE next part to be deſcribed is the *Mouth*, whoſe parts are either *External* or *Internal*. The *External* are the *Cheeks* and *Lips*.

The Cheeks.

As to the *Cheeks*, their ſubſtance being Muſcular, this is no proper place for their deſcription (but Book V.) only we ſhall note from *Steno*, that betwixt their Muſcles and the inner inveſting Membrane of the Mouth there is ſpread on each ſide towards the lower Gums a large conglomerate *Gland*, from whence many ſmall Ducts open into the cavity of the Mouth, pouring *Saliva* thereinto. And as to their *parts* we ſhall obſerve this further, that their upper part next under the Eyes, that jets out a little and is commonly higheſt of colour, is called *Malum* or *Pomum faciei*, in Engliſh commonly the Ball of the Cheek; and their lower part that is ſtretched out in blowing of a Trumpet or the like, is called *Bucca*.

Their glands.

The Lips.

The *Lips* are framed of a carnous ſoft fungous ſubſtance, and of the Muſcles, covered with a thin Skin, under which, on the inſide, eſpecially of the lower Lip, there lie numerous Glands, whoſe excretory Veſſels penetrate the Skin, pouring forth their *Saliva* into the Mouth. They are in number two, the upper and the lower. (Of their *Muſcles* ſee Book V.) The upper Lip has a little dimple in its middle which is called *Philtrum*; and its ſides are named *μύϛαχες*, whence the hair that grows thereon is called *Muſtaches*.

The uſes of the Lips.

The *Uſes* of the *Lips* are theſe: Firſt, they help to retain the Meat in the Mouth, while it is chewing. Secondly, they ſerve for beautifying of the Face, if they be well faſhioned. Thirdly, for the containing of the Spittle in the Mouth, that it ſhould not drivel out conſtantly, but be ſpit out when we pleaſe. Fourthly to keep the Gums and Teeth from external Injuries. Fifthly, for framing of the Speech.

CHAP. XXVI.

Of the inner Parts of the Mouth.

The inner Parts of the Mouth.

THE *inner* Parts of the Mouth are theſe: The *Gums*, the *Teeth*, the *Palate* or *Roof* of the *Mouth*, the *Almonds*, the *Uvula*, the *Tongue*, the *Glands* and *ſalival Ducts*.

1. *Gums.*

The *Gums* (*Gingivæ*) are two, made up of a hard fleſhy ſubſtance, deſtitute of motion, ſet like a Rampire about the Teeth for the keeping of them in their Sockets.

2. *Teeth.*

As for the *Teeth*, look for them in Book VI. Chap. 8.

3. *Palate.*

The Roof of the Mouth is its upper part, ſomething concave like a Vault, formed in the *Os ſphenoides*, and ſerves partly for perfecting of the Voice by repercuſſing the Air, and partly aſſiſts the Senſe of Taſting. It conſiſts of Bones (of which, Book VI. Chap. 6.) of a peculiar glandulous Fleſh and a thick Tunicle, full of little holes for the *Saliva* that is ſeparated in the Glands to deſtill through into the Mouth. *Steno* calls this glandulous fleſh, the *palatine Gland*, and ſays, it is conglomerate, and continued to the *Tonſils*; and that there ſpring out of it innumerable ſlender Ducts which perforating the Membrane make it like a Sieve. The ſame Author mentions alſo two holes that it has in its fore-part, juſt within the Teeth, which come from the Noſtrils.

4. *Almonds.* Of the *Tonſillæ* or Almonds we have ſpoken before in Book II. Chap. *ult.*

5. Uvula. The *Uvula* is a red, ſpongy and longiſh Caruncle, that being ſomewhat broad at its Baſis hangs down from the middle of the Palate (where the Noſtrils open into the Mouth) with a ſmall but bluntiſh End. It is covered with a very lax and ſoft Skin, and is often ſwelled with Defluxions of Rheum, hanging down flaggy, which is called the falling of the *Uvula*, and by ignorant People, the falling of the Roof of the Mouth.

6. *Tongue.* The *Tongue* (*Lingua, à lingendo*, from *licking*) is the Inſtrument of Taſte and Speech. It is long and broad, thicker at the Root than towards the Tip.

Its Membranes. It is cloathed with two *Membranes*; The outer covers onely the upper part of the Tongue, and is very porous, being pretty ſmooth in Men, but in ſome Brutes it is rough, by reaſon of abundance of copped bodies which ariſe out of the upper ſurface of the Tongue, and are cloathed with this Membrane. Which Bodies are of a cartilaginous ſubſtance, and ſtand like the Teeth of Wooll-cards, bending towards the root of the Tongue. This Membrane has a line that runs lengthways of it in its middle, dividing the Tongue into two parts. The *inner* covers the whole Tongue, the lower ſide as well as the upper. This is thin and ſoft, and has many *Papillæ* protuberating out of it, which in the upper part of the Tongue intrude themſelves into the pores of the outer. *Malpighius* makes the outer Membrane to be that which cloaths the ſides and under ſide of the Tongue as well as its upper ſide: and this which we call the ſecond, he names a nervous and papillar body, running through the upper ſurface of the Tongue like a Membrane

Subſtance. As to the *ſubſtance* of the Tongue there is great diverſity of Opinions. Some think it to be a Gland; others, that it has a peculiar ſubſtance; *Spigelius*, that it is truly a Muſcle; and ſo does Dr. *Wharton* call it *verus Muſculus*, though towards its root (he ſaith) it hath ſomething of a glandulous ſubſtance. *Malpighius* (*exercit. Epiſtol. de lingua*, *p.* 9.) ſays, it is rather muſculous than glandulous, and deſcribes its ſubſtance thus. "Immediately under the aforeſaid Membranes "there lie ſtreight fleſhy muſcular Fibres, whereby the Tongue is drawn inwards and ſhortned. "But the centre of the Tongue conſiſts of a manifold kind of Fibres, long, tranſverſe and oblique, which riding one upon another are interwoven like a Mat. This inner part is ſofter "and more luſcious to the taſte than the outer; "not that it is of another ſubſtance, but becauſe "it is looſened and larded as it were by a certain luſcious fat that (eſpecially toward the baſis) fills up the Interſtices of the Fibres; and "there are moreover on the ſides of the Fibres "in this place a ſort of miliary Glands which "give it the more pleaſant reliſh.] But though this be its ſubſtance, yet it cannot properly be called a Muſcle, both becauſe no Muſcle ſerves to move it ſelf, but ſome other part; and alſo becauſe one Muſcle is not moved by another, as the Tongue is by ſeveral pair, to be deſcribed

Connexion. It is *connected* to the *Os hyoïdes*, *Larynx*, and *Fauces*, and by a membranous Ligament to the parts under it. The extremity of which Ligament is called *Frænum*, which being too ſhort, or extended to the tip of the Tongue, hindreth ſucking in Children, when they are ſaid to be Tongue-tied.

Veſſels. Its *Veins* proceed from the external Jugulars, and are very apparent under the Tongue, where they are called *Ranulares.* The *Arteries* come from the *Carotides*. *Nerves* it hath from the fifth and eighth pairs.

Actions and uſes. The *actions* and *uſes* of the Tongue are theſe. Firſt, it is the Inſtrument of Taſting; eſpecially the *Papillæ* in its inner Membrane, which have nervous filaments (running amongſt the fleſhy fibres) inſerted into them. Secondly, it formeth or modulateth the Speech. Thirdly, it helpeth the chewing of meat, by toſſing of it to and fro, and turns it down into the Gullet.

7. Glands. Beſides the *Glands* already mentioned there are ſeveral others, ſome of which are placed in the Mouth, and others, though not ſeated therein, yet diſcharge into it by proper Ducts that liquor that is ſeparated in them, and therefore are properly enough to be treated of here.

Parotides. The firſt are the *Parotides*, which are of two ſorts, *Conglobate* and *Conglomerate*, and are both ſeated in the hollow under the Ear. The *Conglobate* are ſituated on the upper and fore-ſide of the Conglomerate. The *Conglomerate* are of an irregular ſhape, ſuch as the inequalities and eminences of the circumjacent parts grant to them. They were both of them formerly reputed Emunctories of the Brain, and ſuppoſed to ſerve likewiſe for the ſuſtentation of the Veſſels that aſcend this way. But *Steno*, and from him others have found out more noble and genuine uſes for them. The *Conglobate* ſeparate the *Lympha* from the Arterial blood, and conduct it by Lymphe-ducts into the Jugular Veins. The *Conglomerate* have not only inſerted into them Veins and Arteries from the external Jugulars, and *Carotides*, and Nerves from the harder branch of the ſeventh pair; but alſo there ſprings out of each a peculiar Veſſel commonly called a *Salival duct* from the liquor it conveys. This Veſſel ariſes out of it by many ſmall roots, that preſently unite into one Trunk, which running on the outſide of the upper Jaw-bone by a ſtreight courſe (in man) as far as to the centre of the *Muſculus buccinator*, there opens into the cavity of the mouth, into which it diſcharges the *Saliva* which it had imbibed out of the *Parotis* of its own ſide. This is called *Ductus ſalivalis Stenonianus*, from its Inventor *Steno*; or otherwiſe *Superior*, to diſtinguiſh it from the maxillar which is the lower. As to the origine and uſe of the *Saliva*, we ſhall ſpeak thereof by and by.

Their ſalival ducts.

The ſecond Glands I call *Nuckianæ*, being lately firſt deſcribed, with the Salival ducts proceeding from them, by Dr. *Ant. Nuck* a Dutchman. They are ſeated in the orbit of the Skull wherein the Eye is placed, betwixt the abducent muſcle of the Eye, and the upper part of *Os jugale*. Their ſhape is various, in ſome oblong, in others flattiſhly round, in others oval, and in others ſomewhat triangular. Each weighs commonly half a dram or ſomewhat more. They have *Arteries* from the *Carotides*, *Veins* from the *Jugulars*, *Nerves* from the *motory pair* of the Eyes; and he thinks there is no doubt but they have

Nuckianæ.

Their ſalival ducts.

Lymphaticks. Each has a *Salival Duct* ſpringing out of it by many roots, which deſcends ſtreight downwards on the outſide of the Jaw-bone, till it come to the upper part of the Gum in the upper Jaw near to the ſecond double Tooth reckoning from behind forwards, where it empties it ſelf very near the Stenonian one. He calls them *Ductus ſalivales ſuperiores alteri*, to diſtinguiſh them from the foregoing.

Maxillares.

The next Glands are the *Maxillar*, which are either *External*, or *Internal*. The *External* are of leſs moment, being very ſmall. They are ſeated outwardly about the middle of the lower Jaw, where the outer branch of the Carotid Artery, and the external Jugular Vein, with a remarkable branch of the fifth pair of Nerves aſcend into the muſcles of the Face. It is probable theſe have no other uſe, but to ſeparate *Lympha* and to convey it into the neighbouring Jugular Veins. The *Internal* are ſeated immediately within the lower Jaw. Their hinder ſide which is next to the *Parotides* and Jugular Glands, is much thicker and rounder, as alſo redder: but as they reach forwards, they wax thinner by degrees, and are extended betwixt the Jaw and the Muſcles of the Tongue as far forward as to the Chin, as Dr. *Wharton* affirms. They are Conglomerate, and have each a proper Veſſel (firſt found out by the ſaid Author) ariſing out of them as the conglomerate *Parotides* had: which Veſſels are called the *inner* or *lower Salival ducts*, as thoſe ſpringing from the *Parotides*, the *outer* or *upper*; theſe running on the inſide of the lower Jaw, as thoſe did on the outſide of the upper. Theſe Veſſels ſpring by many ſmall roots out of the thicker and hinder part of the Glands, and run ſtreight forwards

Their ſalival ducts.

towards the Chin, but in their paſſage each trunk does here and there receive new twigs ſpringing out of the Gland. When they are come to the middle of the Chin, they end there juſt within the Gums, and have each a certain *papilla* affixed to their Orifice, whereby they can eaſily diſcharge themſelves, and yet nothing return out of the mouth into them.

Sublinguales.

The laſt Glands to be treated of are the *Sublinguales*, to the firſt diſcovery whereof and of their proper Salival ducts, ſeveral pretend. They lie underneath the Tongue on each ſide, and each of them ſends forth a proper excretory Veſſel or ſalival Duct, which running parallel with thoſe of the internal maxillar Glands, open in the ſame *papillæ*, but have a peculiar Orifice of their own, ſtraiter than that of the other.

The uſe of the glands and ſaliva.

Now the *uſe* of all theſe Glands is to ſeparate the *Saliva*, and to convey it into the mouth by the ſalival Ducts. As to the Origine of the *Saliva*, it is moſt probably derived from the Arterial blood. For as the Arteries pour nutritious blood into all other parts, ſo they do into the Glands alſo; part of which they convert into their own nouriſhment, part is returned by the Veins in the circulation, and part (*viz.* of what is ſerous) they ſeparate, and beſtowing a ſubacid quality thereupon make *Saliva* (or Spittle) of it.

To the compoſition whereof (if not for the ſeparation of it) ſome think a nervous juice is contributed, the rather becauſe larger and more numerous twigs of Nerves are communicated to the Glands than to moſt other parts, which yet have a more exquiſite ſenſe than theſe. But in refutation of this Opinion, the above-mentioned Dr. *Nuck* alledges this Experiment: " That if the

“ Nerve that runs to any Gland be either hard “ tied or cut in ſunder, yet the ſecretion of the “ *Saliva* will not thereupon ceaſe, but will only “ proceed more ſlowly;] which ſlowneſs may be attributed, not to the want of any conſtitutive principle of the *Saliva*, ſo much as to the want of that motion in the Gland (that to be ſure depends as well upon the Nerve as upon the pulſation of the Artery) which is neceſſary for the quicker diſpatch of the *Saliva* through or out of the Gland. I ſhall not need to diſcourſe of the manner of the ſecretion of the *Saliva* in the Glands, ſeeing it proceeds like the ſecretion of other parts, (*v.g.* of the Kidneys) *viz.* from the conformity of the particles of the liquor to the pores in the Gland or the mouths of the excretory Veſſel. After its ſeparation, its motion into and along the Lympheducts is much furthered by the muſcular motion of each part reſpectively. Now the *Saliva* is not to be reputed a meer Excrement, for it is believed by all modern Anatomiſts, that it ſerves for the furthering of the fermentation of Meats in the Stomach, if it be not the main ferment of it, as was ſhewed in Book I. Chap. 7. That it has a fermentative quality *Diemerbroeck* proves by this Experiment, That if a piece of white Bread be chewed and moiſten'd with much Spittle, and then be mixed with Wheat-paſte kneaded with warm Water, it will make it ferment. Dr. *Nuck* thinks it is an univerſal ferment for Meats and Drinks, partaking of divers qualities (or particles) but of none in any exceſſive degree. That it is acid, he demonſtrates by this familiar Obſervation: “ That if when Milk is a boiling, one take “ a Spoonful to taſte of, and then preſently “ [illegible]

“ whilſt it is moiſt with the *Saliva*, put it into “ the Milk again (ſtill a boiling) the Milk will “ break as if ſome acid liquor were mixed with “ it.] That it is endued with a volatile Salt, he thinks is evident from its curing Itch, Tetters, *&c.* That oleous particles are mixed with the acid, he ſuppoſes muſt be concluded from its killing Quickſilver. And whereas it uſually becomes frothy in the mouth upon its being agitated by the motion of the Muſcles of the Tongue, and thoſe which move the lower Jaw, that he thinks proceeds from its being endued with a lixivial ſalt and ſpirituous oleous and acid particles, (while the volatile ſpirit vaniſhes.)

The End of the Third Book.

The Fourth Book.

Containing
A Deſcription
OF THE
Veins, *Arteries* and *Nerves*
OF THE
LIMBS:
With an APPENDIX of the
GLANDS thereof.

CHAP. I.

Of the Veins of the Arm.

IN the three former Books we have finiſhed the Deſcription of the three Cavities or Ventricles of the Body; out of which thoſe *Veſſels* ariſing that are propagated to the *Limbs*, it ſeems convenient to ſubjoin thereunto a ſhort

Treatiſe of the courſe that thoſe Veſſels keep in theſe Parts.

In Book II. Chap. 9. treating of the Aſcending Trunk of the *Vena cava* we ſhewed, that when it arrived at the top of the *Thorax* it was divided into two branches called *Rami ſubclavii*; which running obliquely under the *Claviculæ*, aſſoon as they were paſt them and come to the Arm-pit, were called *Axillares.* Now each of theſe parteth it ſelf into two Veins, the *Cephalica* and *Baſilica.* But before their Diviſion they ſend forth two ſmall Veins, *viz. Scapularis interna* and *externa*; whereof the firſt paſſeth to the Muſcles that lie in the cavity or inſide of the *Scapula*, the latter to thoſe on the outſide.

Cephalica. The *Cephalica* paſſeth through the upper or outward part of the Arm, to the bending of the Elbow, where it is divided into two branches; of the which one, joining with the *Baſilica*, makes the *Mediana*, which is very frequently opened when one is let blood in the Arm: The other, marching along the *Radius*, reacheth to the Hand, through which it is ſpread; but chiefly in that part which is between the Ring-finger and the little Finger, where it is called *Salvatella.*

Baſilica. The *Baſilica* paſſeth through the inner and lower part of the Arm, accompanied with the Artery and Nerves.

About its beginning there ſpring out of it the *Thoracica ſuperior* and *inferior*, (though ſometimes theſe ariſe from the Axillar before its diviſion) of which the former runs to the inſide of the Pectoral Muſcle, *&c.* the latter to the *Muſculus latiſſimus* of the Back, and all over the ſide of the *Thorax*, where 'tis ſaid to inoſculate with the twigs of *Vena ſine pari.*

Baſilica about the bending of the Elbow is divided into two; one of which is called *Subcutanea*, running juſt *under the Skin*; and the other *Profunda*, becauſe it lies hid *deep* in the fleſh.

Its Branches.

The *Subcutanea*, or ſhalloweſt branch, near its origine turns up to the outer part of the *Ulna*, and is carried along it to the Hand.

Subcutanea.

The *Profunda* deſcends between the *Ulna* and *Radius*, (but towards the Wriſt is carried by the outer part of the *Ulna*) to the Hand alſo.

Profunda.

The *Mediana* is alſo double, *profunda* and *ſubcutanea*; both which run by many Twigs through the Muſcles of the Cubit to the Hand and Fingers.

The Mediana.

Note, That ſince the Circulation of the Blood has been generally believed, it is held indifferent which of theſe three Veins (the *Cephalica*, *Baſilica*, or *Mediana*) are open'd in blood-letting; for they all receive their *Blood* from one common Artery, *viz.* the Axillar, which returns by them all indifferently towards the Heart: onely it is beſt to open that which is faireſt.

CHAP. II.

Of the Arteries of the Arm.

As ſoon as the *Subclavian* Branches of the aſcending Trunk of the *Aorta* are paſt out of the *Thorax*, they are called *Axillar*, (like the Veins) as we ſhewed in Book II. Chap. 11.

This Artery before it arrive at the Arm ſendeth out of its *upper* part *Humeraria*, which is beſtowed on the Muſcles of the Shoulder; and out of its *lower*, *Thoracica ſuperior*, *inferior*, and *Scapularis*, which run to the ſame parts with the Veins of the like denomination in the fore-going Chapter. Then having communicated ſmall twigs to the Glands in the Arm-pit, it accompanieth the *Baſilica* along the Arm, (for there is no Cephalick Artery.) When it is come to the bending of the Elbow, it is parted into *two* Branches, which paſs almoſt wholly to the inner ſide of the hand; for the backſide hath no Artery but from a ſmall twig that runs betwixt it and the bone of the Thumb.

The *one* of theſe reſting upon the *Radius*, is that which beats about the Wriſt, and is commonly felt by Phyſicians.

The other marcheth by the *Vlna*, and with the former is ſpread through the Hand.

CHAP. III.

Of the Nerves of the Arm.

THE *Nerves* that ſpring from betwixt the two loweſt *Vertebræ* of the Neck, and the firſt two of the Back, (ſome ſay, three of the Neck and three of the Back) do every one ſend a branch towards the Arm; all which for their greater ſtrength uniting with one another, and again ſeparating are carried under the *Claviculæ* to the Arm-pit, where they unite together again and are called *Axillar*; but they paſs out from thence again ſeparate one from another. The firſt of them goes to the Muſcle *Deltoides*, to the ſecond Muſcle of *Os hyoides*, and to the Skin of the Arm. All the other five are beſtowed wholly on the Muſcles and Skin of the Arm and Hand.

CHAP. IV.

Of the Veins of the Thigh, Leg, and Foot.

THE Iliacal Branches of the *Vena cava* after they are deſcended as far as the Thigh (where we left them *Book* I. *Ch.* 13.) are called *Crurales*, which being paſt the Groins are each divided into ſix more notable Veins, *viz. Saphœna*, *Iſchias major* and *minor*, *Muſcula*, *Poplitea* and *Suralis*. The firſt called *Saphœna* deſcends down on the inſide of the Thigh and Leg betwixt the Skin and *Membrana carnoſa*, and appears pretty large on the inſide of the Ankle, where it is frequently opened in Diſeaſes of the Womb, and *may* with great ſafety, having neither Artery nor Nerve accompanying of it. The *Iſchias major* is that which runs down on the outſide of the Ankle (where it is wont to be opened in the *Sciatica*, or other diſtempers of the Hips;) but the *minor* goes no further than the Muſcles of the Hip. The other three are ſpent on the Muſcles, Skin, *&c.* of the Thigh, Leg and Foot.

CHAP. V.

Of the Arteries of the Thigh, Leg, and Foot.

IN *Book* II. *Ch.* 11. deſcribing the deſcending Branches of the *Aorta*, we traced them to the Thighs, where the *Rami Iliaci* begin to be called *Crurales*, as was ſaid of the Veins. The Crural Artery is leſs than the Vein, and before it arrive at the Ham ſendeth forth three Branches, *viz. Muſcula cruralis exterior*, *interior*, and *Poplitea.* The firſt enters the fore Muſcles, the ſecond the inner Muſcles of the Thigh; and the third runs down the hinder Muſcles as low as the Ham, whence it has its name. When the trunk of the Crural Artery is paſt the Ham, it ſends out three more called *Tibiæa exterior*, *poſterior elatior* and *poſterior humilior*, which are beſtowed on the Muſcles, Skin, *&c.* of the Leg and Foot; and what remains of it deſcends to the Foot, upon which it is ſpent.

CHAP. VI.

Of the Nerves of the Thigh, Leg, and Foot.

THE three lower pair of Nerves of the *Vertebræ* of the Loins, and the four uppermoſt of *Os ſacrum* conſtitute the Crural

Nerves. For all theſe very near their Riſe joining together, and proceeding united for a while, make four Nerves. The *firſt* and *third* enter the Muſcles that lie upon the Thigh-bone whether for *its* Motion, or of the Leg. The *ſecond* accompanies the Crural Vein and Artery down by the Groins and the inſide of the Thigh, on whoſe formore Muſcles it is moſt of it ſpent, but ſends one notable Branch down the Leg, as far as to the great Toe. The *fourth* is the thickeſt, hardeſt, and ſtrongeſt of all the Nerves in the Body. This diſtributeth Twigs to the Skin of the Buttocks and Thigh, to the Muſcles of the Thigh and Leg, and being deſcended to the Ham is divided into the outer and inner Branches, which beſtow Twigs on all the Muſcles and Skin of the Leg and Foot, to which there comes no other Nerve, but the aforeſaid Branch of the *ſecond.*

AN

AN APPENDIX TO BOOK IV.

Of the GLANDS of the Limbs.

HAving finiſhed the Deſcription of the Veſſels of the Limbs, this ſeems the fitteſt Place to mention the Glands of the ſame, ſeeing theſe miniſter to thoſe, either as ſupporting them in their paſſage, according to the Ancients; or as ſeparating *Lympha* from the Arteries, according to ſome Moderns, (or Superfluities from the Nerves, according to others) and returning the ſame by Lympheducts into the Veins.

Glands of the Groin and Arm-pit.

The moſt conſiderable of theſe Glands are thoſe in the Groin and Arm-pit. The former are called *Bubones*, (not only when ſwell'd, but alſo in their natural ſtate) and are commonly about eight. The latter are called *Axillares*, from their ſituation. Theſe are ſmaller than the other, and fewer in number, ſeldom exceeding three.

Their Uſe.

The Groins and Arm-pits the Ancients called Emunctories; the one of the Belly, the other of the Breaſt. And beſides the ſupporting of the diviſions of the Veſſels, all the *Uſe* aſſigned to theſe Glands was, to imbibe a moiſture from the Blood for the nouriſhment of the Hair that grows in theſe parts. But ſeeing in the Groins where the moſt and largeſt Glands are, there grows little or no hair, (moſt of that, growing upon the region of the *Os Pubis* where are no Glands at all) this ſeems not to be the proper uſe of them; and indeed it is too trifling and vile. The true Uſe, as of all other conglobate Glands (of which ſort theſe are) is, to ſeparate the *Lympha* from the Arterial Blood, and to tranſmit it by the Lympheducts into the Veins, in which it is conveyed back together with the Venal Blood to the Heart.

The Pope's Eye.

In the middle of the Thigh on the inſide (about the middle of the length of the *Muſculus ſartorius*) is a pretty conſiderable Gland, which we commonly call in Sheep *the Nut* or *Pope's Eye.* This is of the ſame kind and uſe with the former; as are alſo the following.

The Glands in the Ham and the bending of the Arm.

In the Ham near the flexure there is a ſmall Gland, and a ſmaller than that near the bending of the Arm a little above the Tendon of the *Muſculus biceps.* But theſe are ſo ſmall, that the very mentioning of them is ſufficient.

The End of the Fourth Book.

[illegible] certain [illegible] the proper [illegible] and [illegible] it is too tedious, and [illegible] Glands [illegible]

[illegible]

The Fifth Book.

CONTAINING
A Treatiſe of all the
MUSCLES
Of the BODY.

CHAP. I.

Of a Muſcle in general, and of its parts.

A Muſcle. Its name.

A *Muſcle* in Greek is called μῦς a *mouſe*, (of which *Muſculus* in Latine is but a diminutive) either becauſe it reſembles a fley'd Mouſe; or elſe from μύω to *contract*, which is its action. And under this denomination is underſtood all that which is properly called fleſh; which is not one continued ſubſtance through the whole Body, but conſiſts of divers parts or parcels, that have no continuation of ſubſtance, but lie only contiguous to one another in ſuch convenient and decent order and ſituation, as may conduce to the comelineſs of the Body, and the performance of each one's particular office.

Definition. Now a Muſcle is rightly defined to be a *diſſimilar or organical part*, (framed of its proper Membrane, fibrous fleſh, a Tendon, Vein, Arterie and Nerve) *appointed by nature to be the inſtrument of free motion.*

Conſtitutive parts, viz. *common and proper. The common are Arteries, Veins, and Nerves.*

By which definition ſeeing it appears to be a diſſimilar part, conſiſting of many ſimilar, we ſhall in the firſt place examine what theſe are. They are either *common* or *proper*. The *common* are three: The Vein, the Artery, and the Nerve. The *proper* as many, *viz.* the fibrous fleſh, the Membrane, and the Tendon.

The *Arteries* convey to the Muſcles, (as to all the other parts of the Body) Vital heat and nouriſhment; and according to Dr. *Willis*, a *latex* that in motion effervefces with the Animal Spirits; the *Veins* carry back from them what blood is not aſſimilated to them; and the *Nerves* bring Animal ſpirit whereby their action is performed. And theſe Nerves ſpring either from the *medulla oblongata* within the Brain; or from the *ſpinalis*, ſo called after it is deſcended out of the Skull into the Spine. Dr. *Willis* is of opinion, that the Nerve which enters every particular Muſcle, is ſingle and peculiar from its very Original, though it be included in a common coat with many others: otherwiſe he cannot conceive how the Animal ſpirits which are directed by the Soul along the Trunk of any Nerve, for ſuch or ſuch a particular motion, ſhould hit the way into one branch rather than another. As ſoon as it hath entred into the ſubſtance of the Muſcle, it is divided into innumerable twigs, which in a little ſpace from its inſertion become ſo very ſlender and fine, that they eſcape the ſight. Some make Lymphatick Veſſels common parts of a Muſcle, but according to *Steno*'s obſervation, though they run along their ſurface, they do not enter into them.

Why called common.

Now theſe are called the *common* parts of Muſcles, becauſe they are common to *them* with *other* parts of the Body that are endowed with the ſame kind of Veſſels. But as to each particular Muſcle, they have every one their peculiar and proper Veſſels, numerically diſtinct. That is, though thoſe twigs of Veſſels that are inſerted into one Muſcle, be propagated from the ſame Trunks from which other twigs paſs to other Muſcles; yet thoſe twigs, whether of Arteries, Veins or Nerves, that are beſtowed on one Muſcle, are wholly ſpent thereon, and paſs not out through its inveſting Membrane again to any other.

The proper why ſo called.

The *proper* parts are ſo called, becauſe they are proper and peculiar to a Muſcle, and not common to any other part.

Theſe are, 1. Fibres. (1.) Fleſhy.

The firſt of theſe is *fibrous fleſh*, or *fleſhy fibres*, which ſome diſtinguiſh into two parts, *fibres*, and *fleſh*: and fibres again into *fleſhy*, and *membranous.*

A *Fibre* is thus defined by Dr. *Gliſſon* in Cap. 4. de Ventric. *A Body in figure like a thread, ſlender, tenacious, tenſile, and irritable, made of ſpermatical matter, for the ſake of ſome motion and ſtrength.* Which he thus explains: “*In figure like a thread*] “*i. e.* oblong and round; *ſlender*] like a Spider's “web: *tenacious*] whoſe parts firmly cohere and “are not eaſily broken; *tenſile*] viz. that may be “extended as to longitude, its latitude being leſ“ſen'd, and in like manner that may be thicken'd “as to latitude, its longitude being ſhorten'd; “*irritable*] i. e. which by irritation may be exci“ted to contract it ſelf, and the irritation ceaſing,

" to be remitted of its own accord; *made of ſpermatick matter*] namely if it be a bare Fibre; " but if it be ſtuft with a *parenchyma*, perhaps it " is not always made of only ſpermatick matter; " (for the ſtuft Fibres may be divided into ſanguineous and ſpermatick; of the former kind " are thoſe of the Muſcles; of the latter, thoſe " of the Stomach and Guts:) *for the ſake of ſome* " *motion and ſtrength*] for in that it is tenacious it " adds ſtrength to the part, and that which is " apt to be extended and contracted, is deſtin'd " for ſome motion.]

Their courſe. Theſe *fleſhy fibres* are commonly *ſtreight*, but not *always*, for ſometimes they run *round*, as in the Sphincters.

(2.) Membranous. Beſides theſe fleſhy fibres, ſome later Anatomiſts deſcribe another ſort which they call *membranous*, running from Tendon to Tendon overthwart the other, cloathing them and knitting them to one another; and make them to communicate to the fleſhy ones their motory inſtinct, and alſo to convey to the Tendons the Spirits which flow into the belly of the Muſcle by the Nerves, as likewiſe the ſame Spirits from the Tendons back again to the belly of the Muſcle, as there is occaſion.

Fleſh what, and of what made. The Fibres being ſtuft in their Interſtices with a ſanguineous *parenchyma*, are that which we properly call *fleſh*. For (ſaith Dr. *Croone*) all the fleſh of a Muſcle (which makes the greateſt part of it, and of which the bulk of the whole Body chiefly conſiſts) ſeems to be nothing elſe but that portion of the blood that flows through the intervals of the Fibres, which thickning by their coldneſs is ſtaid amongſt them. *Steno* denies any *parenchyma*; and ſays, that every Fibre is tendinous at both ends, and carnous in the middle; and that the ſame Fibres which being ſtraitly knit to one another, make the Tendon; being more looſly joyned, make that we call fleſh: But I think not ſo probably. In ſome Muſcles in fat people the (lean) fleſh is interlarded with ſome fat: but that fat is not a neceſſary part of a Muſcle, ſeeing it is not in all Muſcles even in fat perſons; and in very lean, none.

2. *A Membrane.*

Every Muſcle hath a proper *Membrane* that inveſts it, and diſtinguiſhes it from others. Whereto its Origine is owing, is difficult to determine. 'Tis moſt probable, that 'tis made out of the Fibres expanding themſelves at their ends; to conceive which we muſt underſtand that the Fibres run not lengthways of the Muſcle ſo as to reach from one end of it to the other; but from one ſide of it to another, yet not directly but a little ſloping. Notwithſtanding (ſo long as they continue fleſhy) they are ſtreight in figure, if you conſider them apart, and run parallel one by the ſide of another. But ſuppoſing this to be the Origine of this Membrane, (which I propoſe as doubtful) we muſt not conceive that the Fibres are wholly ſpent thereupon ſo as to terminate there; for under this Membrane they run (being diveſted of their *parenchyma*) lengthways of the Muſcle, and conſtitute its Tendon.

3. *A Tendon. Its definition.*

The laſt *proper* part of a Muſcle is the *Tendon*, which *Spigelius* defines thus: *It is a ſimilar and ſimple part, of a peculiar kind, diffuſed through the whole body of the Muſcle lengthways, which in ſome part thereof is united,* (and there it is white with a kind of brightneſs, denſe, hard and ſmooth) *and in ſome divided and ſtuffed with fleſh* (where it is not eaſily diſcernible:) *and ſeeing it is very much*

adapted

adapted for contraction, when it is contracted at our pleaſure, it moves together with it ſelf that part into which it is inſerted. *Steno* affirms the riſe of a Muſcle to be tendinous, as well as its inſertion; and defines a Tendon to be a body continued from the beginning of Muſcles to their end.

Which Muſcles have Tendons.

All Muſcles which are appointed for the moving of bones, have Tendons which are inſerted into thoſe bones they are to move: but commonly thoſe which move other parts, as the Tongue, Lips, *&c.* as alſo the Sphincter of the Bladder, and *anus*, have none, or however ſuch as are not eaſily diſcoverable; for indeed ſome affirm (as Dr. *Croone*) that every Muſcle has its Tendon.

Of what they are framed.

There are ſundry Opinions as to the *ſubſtance* of a Tendon. *Spigelius* (as appears by the foregoing definition) thinks it to be a *ſimple* part, that is, *truly* ſimilar, and not appearing ſo to the Eye only. He ſays, it is neither a Nerve, nor a Ligament, nor is it a ſubſtance mixt of both; but it is a part of its own proper kind, ſofter than a Ligament, and harder than a Nerve. *Veſalius* on the other hand affirms (with *Galen*) that it is a diſſimilar body, compoſed of a concourſe of Fibres, Ligaments, and very ſlender Nerves, growing by degrees into one body. *Diemerbroeck* doubts not but that the Nerve which enters into any Muſcle, is extended as far as its Tendon (though it cannot be traced by the Eye thither) becauſe of the very acute ſenſe of the Tendon; and yet the Tendon, he ſays, is not a meer Nerve, but 'tis likely that the Fibres and Membrane with a Ligament are intermixed with it.] I think 'tis moſt probable, that it is only a production or prolongation of the Fibres freed from their *parenchyma*, and clothed with the inveſting Membrane of the Muſcle, which it ſelf ſeems alſo to be derived from the Fibres, as was noted above. But whatever its ſubſtance be determin'd to be, it has always been held to be the principal part of the Muſcle, and the chief inſtrument of its action; though according to *Steno*, it is not it ſelf that contracts, but the fleſhy Fibres by its means. Dr. *Willis* thinks that the Animal Spirits which reſide in the Muſcle, do in ceſſation from motion retire into the Tendons, and in motion are darted from thence into the *parenchymatous* or fleſhy part, where they are joyned with more, flowing in by the Nerves.

Their figure.

The Tendons are ſometimes round, as in the *Muſculus biceps*; ſometimes broad, as in the oblique and tranſverſe Muſcles of the Belly.

The parts diſtinguiſhed from the poſition.

Theſe are the *parts conſtitutive* of a Muſcle. It hath beſides theſe, parts derived from the *Poſition* (or rather from its action) and thoſe are three: The Head, the Tail, and the Belly. The *Head* or beginning is that part of the Muſcle that ariſes from the part *unto* which the contraction is made: the *Tail* or *end* is that part of it which is inſerted into the part which is moved: the *Belly* is all that (fleſhy) part that lies betwixt the Head and Tail. *Steno* thinks the *Head* and *Tail* of a Muſcle are better expreſt by the *two Extremes*: ſeeing if that be the Head to which the contraction is made, then neither extream, but the middle or *belly* is the head, becauſe both the extreams in contraction move towards *it*: or if any will contend that one end is moved towards the other, the ſame end is not always the quieſcent one in all the motions of every Muſcle; and therefore the ſame end in ſeveral motions being ſometimes the Head, and otherwhiles the Tail, this diſtinction breeds but a confuſion.

The uſe of a Muſcle.

The *uſe* (or rather *action*) of a Muſcle was intimated in the laſt part of the definition, in that it was ſaid to be the inſtrument of *free* motion; which word we rather make uſe of than of *voluntary*, becauſe Beaſts have Muſcles and motion, unto whom *will* properly ſo called is denied, becauſe it ſuppoſeth reaſon. But hereof more in the next Chapter.

CHAP. II.

Of the Differences and Action of the Muſcles.

The differences of Muſcles.

THE *Differences* of Muſcles are taken from ſundry things: *Firſt*, from their *Subſtance:* ſo ſome are fleſhy, as moſt of the Tongue and *Larynx:* ſome are membranous, as the *Conſtrictores* or internal *Adducents* of the Noſe: and ſome art partly fleſhy, and partly nervous, as the temporal.

Secondly, from their *quantity:* whence ſome are *long*, as the ſtreight Muſcles of the *Abdomen*, the longeſt of the back, *&c.* others *ſhort*, as the pyramidal at the bottom of the *Abdomen:* ſome *broad*, others *narrow*: ſome *thick*, others *thin* and ſlender, *&c.*

Thirdly, from their *ſituation:* from hence ſome are called *external*, ſome *internal*; ſome *oblique*, ſome *ſtreight*, ſome *tranſverſe*.

Fourthly, from their *figure:* as *Deltoides*, becauſe

cauſe it reſembleth the Greek letter Δ *delta*; ſome *round*, others *ſquare*, *&c.*

Fifthly, from their *beginning:* ſo ſome proceed from *bones* one or more: ſome from *Cartilages* or griſtles, as thoſe of the *Larynx*; and ſome from the Membrane that inveſts the Tendon of ſome other Muſcle, as the *Lumbricales* of the Hands and Feet.

Sixthly, from their *inſertion:* ſome being inſerted into *bones*, as moſt are; ſome into *Cartilages*, as the Muſcles of the Eye-lids, *&c.* others into a *Membrane*, as thoſe of the Eye, *&c.*

Seventhly, from their *compoſition* or *variety of parts*; ſo ſome are called *bicipites* and *tricipites*, having two or three heads; others *biventres* having two bellies.

Eighthly, from their *action:* from whence four differences of Muſcles are taken: for *firſt*, ſome are hence called *fraterni* or *congeneres*, brotherly, becauſe they aſſiſt one another in their action; ſome *antagoniſtæ*, Adverſaries, becauſe they have an oppoſite motion. *Secondly*, ſome only move themſelves, as the Sphincters; ſome other parts, as the reſt. *Thirdly*, ſome have one only action, as the greateſt part of the Muſcles; ſome have divers actions, as the *maſſeter* and *trapezius*. The *fourth* difference is taken from the variety of the action; ſo ſome are called *flexores*, others *extenſores*; ſome *elevatores*, others *depreſſores*; ſome *adductores*, others *abductores*. Others *ſuſpenſores*, *rotatores*, &c.

Thus much of the *Differences* of Muſcles one from another: in the next place proceed we to their *Action*, in which they all agree.

Their action. Now the proper *Action* of a Muſcle is the *contraction* of it ſelf, whereby it brings the part from which it ariſes and that into which it is inſerted, nearer to one another. But whether this contraction be from the repletion, or from the inanition of its Fibres, or by both theſe, or which way elſe, we ſhall not ſpend time to Philoſophize, nor is it agreed on among learned men.

The efficient cauſe, and mediate inſtrument thereof. The *Efficient cauſe* of this Action is the Soul or the Loco-motive, Animal Faculty, which being invited, or offended by ſome object, moves the whole body, or ſome member of it, in purſuance or avoidance thereof; of which motion the Muſcle is the *immediate* inſtrument, but the Nerves conveying the Animal Spirits to the Muſcle, are the *mediate*.

The differences of their motion. I ſaid even now that the *proper* action of a Muſcle is contraction, but that is not the only motion it is capable of, for Anatomiſts commonly aſcribe to it four different motions: The *firſt* is that already mentioned, *viz.* contraction; the *ſecond* is the perſeverance of the contraction: the *third*, the relaxation of the contraction; and the *fourth*, the perſeverance of the relaxation. The perſeverance is called *motus tonicus*, whenas the member is ſtill kept in the ſame poſture.

Theſe four motions are common to every particular Muſcle: but there are others which agree ſome to one, ſome to another, in reſpect of their ſituation, or the courſe of their Fibres: So a ſtreight Muſcle hath a ſtreight motion; a tranſverſe, a tranſverſe motion; an oblique, an oblique; and a ſphincter, an Orbicular.

The reaſon and manner of motion.

As for the *reaſon* and *manner* of motion whereof different Authors have invented various *Hypotheſes*; as it would be too *large* a task to examine theſe, ſo I think it too *difficult* to explain thoſe. And therefore waving all ſuch ſpeculative and conjectural Diſcourſes, and frankly declaring with *Steno*, That to me *non liquent*, I proceed to the Deſcription of the Muſcles themſelves, wherein I may appeal to the Hand and Eye of any skilful Diſſector.

CHAP. III.

Of the Muſcles of the Eye-lids and Fore-head.

The Muſcles of the Eye-lids, viz. Recti,

THE upper Eye-lids are moved very manifeſtly, the lower more obſcurely; wherefore the upper have each a Muſcle that the lower want, which is called *rectus* or *aperiens*, ſerving to pull it up. It is placed in the upper region of the orbit of the Eye, and ſpringeth from the ſame origin with the *Elevator* of the Eye, (above it) namely at the hole through which the optick Nerve paſſes into the orbit, and holds the ſame courſe with it, being of the ſame Figure and Subſtance, *viz.* fleſhy, till at laſt parting from it, with a pretty broad but thin Tendon it is inſerted into the Cartilage of the upper Eye-lid, which it ſerves to lift up, and ſo to open the Eye.

Theſe, I ſay, are proper to the *upper* Eye-lids; but the following belong to the *lower* as well as upper.

They

And Semicirculares.

They are called *Claudentes*, or ſhutters of the Eye-lids, as alſo *ſemicirculares*; (others call them *Circulares* taking them for one.) They are placed between the *membrana carnoſa* and the inner Membrane of the Eye-lids that is extended from the *Pericranium*. That which draweth down or ſhutteth the *upper*, is the larger, and ariſeth from the inner corner of the Eye and that part of the *Supercilium* that is next to the Noſe, with a ſharp beginning: from whence it paſſeth tranſverſly toward the outward corner, growing preſently fleſhy and broader, ſo that it filleth up all the ſpace betwixt the Eye-brow and the loweſt edge of the Eye-lid on which the Hairs grow, (which is called *Cilium* or *Tarſus*) and at length is inſerted into the outer corner. That which moveth the *lower* (though but obſcurely) in order to ſhut it, is leſs, being membranous and thin, ariſing from the ſide of the Noſe with a ſharp beginning as the other; whence being carried tranſverſly it comes to the middle of the Eye-lid, where becoming ſomething fleſhy it continues its courſe to the outer corner which it turns about, and aſcending to the upper Eye-lid is inſerted into it with a broad end. Theſe two Muſcles being contracted ſhut the Eye, the greater drawing down the upper Eye-lid, and the leſs pulling up the lower. But the lower has no Muſcle to pull it down again, ſeeing its own gravity and the relaxation of its Fibres is ſufficient for that purpoſe: whereas the upper, as was obſerved before, has a peculiar Muſcle to pull it up.

The Frontales.

Yea, beſides the *Recti* aforeſaid, there ſometimes concur, when we would open our Eyes very wide, the *Muſculi frontales*, or Muſcles of the forehead, which ſpring from the Skull near the coronal ſuture, and having their outer edge knit to the temporal Muſcles, are contiguous to one another with their other ſide upon the middle of the fore-head, upon which they deſcend with ſtreight Fibres to the Eye-brows, where they terminate. By the help of theſe we draw up and wrinkle the fore-head, and by conſequence pull up the upper Eye-lid a little. The Skin grows very cloſe to theſe Muſcles.

Corrugantes.

Some deſcribe another pair of Muſcles of the Fore-head, called *Corrugantes*, whoſe Fibres deſcending a-ſlant from the lower part of the *Frons* betwixt the Eye-brows towards the top of the Noſe, (where they meet one another) help to knit the Brows (as we call it) when we frown. But theſe ſeem to be onely a part of the frontal Muſcles, having their Fibres running in this place a little obliquely.

CHAP. IV.

Of the Muſcles of the Eyes.

Each Eye hath ſix Muſcles.

THE Muſcles of each *Eye* are in number ſix; four *ſtreight*, and two *oblique*. The *ſtreight* move the Eyes upwards and downwards, to the right hand and to the left: the *oblique* move them obliquely. The *ſtreight* are more thick and fleſhy than the *oblique*.

Four ſtreight.

Their Riſe and Inſertion.

As to their beginning, (*viz.* of the *ſtreight*) they have all the ſame origine; as to their progreſs, the ſame ſtructure; and as to their end, the ſame inſertion. Their *Origine* is contiguous and acute, being at the hole through which the optick Nerve enters the orbit of the Eye, from whoſe Membrane they ſpring. Their *middle*, or belly, is fleſhy and almoſt round. Their end is a moſt thin and membranous Tendon, whereby they are inſerted into the *tunica cornea*, where it is pellucid, near the *Iris*, and ſo do encompaſs the whole Eye before as far as it is white.

The *firſt* of the *ſtreight* is called *attollens* or *Elevator*, becauſe it moveth the Eye upwards; and it is ſomewhat larger than the ſecond that moveth the ſame downwards, becauſe it requireth greater force to pull any thing upwards than downwards. This firſt is otherwiſe called *ſuperbus*, becauſe that motion of the Eye is owing to it, when we are ſaid to look high. For which reaſon the *ſecond* has the name of *humilis*, becauſe by it we look down; whence alſo it is otherwiſe named *deprimens*. The *third* is called *adducens*, becauſe it moveth the Eye inwards towards the Noſe; as alſo *bibitorius*, becauſe we are wont to uſe it to look into the glaſs or cup when we drink. The *fourth* is called *abducens*, from its drawing the Eye outwards from the inner corner to the outer; and alſo *indignatorius*, becauſe that motion or caſt of the Eye (as we call it) is proper to Men in the Paſſion of Anger.

The firſt is placed in the upper region of the orbit, the ſecond in the lower, (oppoſite to the upper) the third in the inner corner of the Eye, the fourth in the outer.

Two oblique. Their Riſe and Inſertion.

The *oblique* Muſcles are called *circumagentes*, winders or rollers about, and *amatorii*, or amorous; and are in number two. The *firſt* is *obliquus major*, or *ſuperior*, the upper and larger. This beginneth at the hole by which the Optick Nerve enters into the orbit of the Eye, as the four foregoing

going Pair did, and paſſing to the upper part of the inner corner of the Eye, endeth in a ſmall and round Tendon, which paſſeth thro' a tranſverſe cartilage there placed, (called by *Fallopius Trochlea*) as a cord thro' a pully, and is inſerted into the upper ſide of the *Cornea*, betwixt the *attollens* and *abducens*. This ſeems to be a very conſiderable Muſcle, ſeeing the fourth pair of Nerves (called *Nervi pathetici*) are wholly ſpent upon it, according to Dr. *Willis*. The *ſecond* is *obliquus minor*, or *inferior*, the lower and ſmaller. This ſpringeth from the lower and almoſt outer part of the orbit, (namely at the juncture of the firſt bone of the upper Jaw with the fourth) with a carnous beginning. It is ſlender but not quite round, and paſſeth obliquely to the outer corner of the Eye, which having turned about, it ends in a ſhort roundiſh and nervous Tendon, which meeteth with the Tendon of the other oblique Muſcle, and is inſerted obliquely near the *Iris* betwixt the Tendons of the *attollens* and *abducens*, with the other, ſo that both ſeem to have but one Tendon. This rolleth the Eye towards the Noſe, as the other draweth it from it.

How theſe Muſcles are to be ſhewed.

Before you ſhew the Muſcles of the Eye, cut off the fat with your ſciſſers, then ſhew firſt the *obliquus major*, then the *obliquus minor*, and laſt of all the four ſtreight Muſcles. Nevertheleſs let the *obliquus major* remain laſt, when all the reſt are taken away, that you may ſhew how the Tendon of it paſſeth through the *Trochlea* or pully the more plainly.

Trochlea.

Which *Trochlea* is thus deſcribed by *Spigelius*: *It is a little round Cartilage, hollowed like a Pipe or piece of a ſtraw, that is ſuſpended by a Ligament in the inner corner of the Eye*, through which the Tendon of the greater oblique Muſcle paſſing, procures unto that Muſcle the name of *Trochlearis*.

CHAP. V.

Of the Muſcles of the Noſe.

The Noſe hath four Pair.

THE *Noſe* is not all of it moveable, but only its lower griſtly parts, which are called *Alæ* or *Pinnæ*. And theſe are either drawn together to ſhut the Noſtrils, which is performed by the *adducent* Muſcles; or drawn aſunder to open the Noſtrils, which is done by the *abducent*. And there are two Pair to ſerve each Office.

Before I enter upon the Deſcription whereof, I deſire it may be noted, (once for all) that though all the Muſcles of the Body be double (except the Sphincters) ſo that they are commonly reckoned by *Pairs*; yet in their Deſcription we ſhall ſpeak of them in the ſingular number, as if there were but one of a ſort. Which method (after this advertiſement) can occaſion no miſtake or inconvenience, ſeeing all the particulars that agree to one, agree to its fellow likewiſe.

Two abducent.

The *firſt* of the *abducent* or opening Muſcles is ſmall, rather Carnous than Membranous, ariſing from the upper Jaw-bone, near the firſt proper Muſcle of the Lips, and is inſerted partly into the lower part of the *Ala* of the Noſe, and partly into the upper part of the upper Lip, by the dimple in its middle which is called *Philtrum*. The *ſecond* covering the ſide of the Noſe, begins at its top near the *foramen lachrymale*, with an acute and fleſhy Origine, and deſcending obliquely by the bone of the Noſe it ends in a broad Baſis, and ſtill remaining fleſhy is implanted into the *Ala*. It is near of a three-ſquare or triangular ſhape, like the Greek Letter Δ *delta*, whence it is called by ſome *deltoïdes.* Theſe two by drawing the *Ala* upward widen and open the Noſtril.

Two adducents

The *adducent* or cloſing Muſcles are very ſmall ones, ſo that they can hardly be diſcovered or diſtinguiſh'd exactly but in them that have large Noſes. The *firſt* of theſe is *external* and fleſhy, riſing about the root of the *Ala*, which it aſcends, creeping tranſverſly over it to the ridge or tip of the Noſe, into which it is inſerted. The *ſecond* is *internal*, and is hid in the cavity of the Noſtril under the inner coat that covers it: it is membranous, and ariſes from the extremity of the bone of the Noſe, where the Cartilage is joined to it, and is inſerted into the *Ala.* The former being contracted depreſſes the *Ala*; the latter draws it inwards, and ſo cloſes or conſtringes the Noſtril. And to the ſame end or purpoſe there is another that ſerves, (which is common) namely the *orbicularis* of the upper Lip, which by drawing the Lip downwards, doth at the ſame time conſtringe the Noſtrils.

Bartholin writes, that beſides theſe Muſcles, he has ſometimes found a ſmall carnous Muſcle reaching ſtreight down from the frontal Muſcle (with a broad Baſis, but preſently growing narrower) and ending about the Cartilage of the Noſe. Such as have this Muſcle can draw their Noſe (eſpecially its skin) a little upwards: which motion we uſe, when (as *Horace* ſpeaks) *ſuſpendimus aliquem naſo*, we jeer or ſcoff at one.

CHAP. VI.

Of the Muſcles of the Lips and Cheeks.

Muſcles common to the Cheeks and Lips.

THE Muſcles of the *Lips* are either *common* to the *Cheeks* and *Lips*, or *proper* onely to the *Lips*.

1. Detrahens quadratus.

The *common* are two on each ſide. The *firſt* is called *detrahens quadratus:* this is a thin but broad Muſcle, reſembling a Membrane interlaced with fleſhy Fibres. It hath its beginning from the hinder ſide of the neck, the ſhoulder-blade, the *clavicula* and the breaſt-bone, and mounting up by oblique Fibres to the Face, is implanted into the Chin, Lips, and root of the Noſe; which parts it draws obliquely downwards. Sometimes it proceeds alſo to the root of the Ear, and is reckoned for one of its Muſcles. It is called *quadratus* or four-ſquare from its ſhape. When a convulſion happens in this Muſcle, it cauſes the *ſpaſmus cynicus*, which we can imitate voluntarily by drawing down one ſide of the Mouth.

2. Contrahens.

The *ſecond* is called *contrahens*, or *Buccinator* the Trumpeter. This lieth under the former, in the upper part of it. It makes up all that part of the Cheek which is diſtended in blowing hard. It ſprings from the Gums of the upper Jaw, and ends in thoſe of the lower. Moſt Anatomiſts deſcribe it to be of a round figure. It is thin and membranous, interlaced with divers Fibres, and is knit ſo cloſe unto the Membrane which covereth the inſide of the Mouth, that it can hardly be ſevered from it. This Muſcle is not only of uſe to move the Cheeks with the Lips, but when it is contracted, it turneth in the meat upon the Teeth again, that had got to betwixt them and the Cheek, in chewing of it.

Muſcles proper to the Lips.

The Muſcles *proper* to the Lips, are *five* Pair, and one odd one. The *Firſt* is *par attollens.* If both of theſe act together, they draw all the upper Lip directly upwards and outwards; but if onely one, then is but one ſide of the Lip drawn up obliquely. Each ſpringeth from the firſt bone of the upper Jaw, where the Ball of the Cheek is. At its Riſe it is broad and fleſhy: from thence marching obliquely to the fore-part, it is inſerted into the ſide of the upper Lip near to the Noſe. 1. Attollens.

The *ſecond* is called *abducens*, and aſſiſteth the motion of the former, or rather draweth the upper Lip more to one ſide. It ariſeth out of the Cavity that is under the Ball of the Cheek with a fleſhy but ſlender and round beginning, and being covered with much Fat, it is implanted into the *frænum* where the Lips meet, at the corner of the Mouth. 2. Abducens.

The *third* Pair is called by *Riolanus*, *Zugomaticum* or *Jugale*, becauſe it ariſes outwardly from the Jugal Proceſs. It is fleſhy and round, and deſcending obliquely through the Cheek, is terminated near the corner of the Mouth, and ſerves to draw both Lips upwards ſide-ways; for it is common to them both. 3. Jugale.

The *fourth* Pair is the *deprimens*, which pulleth down the lower Lip. It ſpringeth broad and fleſhy from the lower and fore-ſide of the Chin, from whence aſcending obliquely, it is inſerted into the middle of the under Lip, continuing broad from its Origine to its End. 4. Deprimens.

The *fifth* Pair may be called *obliquè detrahens*, for it draws the lower Lip obliquely downwards 5. Obliquè detrahens.

and outwards. It ſprings from the lower ſide of the lower Jaw with a fleſhy and broad beginning, (being ſometimes extended to the middle of the Chin) from hence it goes upwards, and growing narrower by degrees it is inſerted obliquely into the lower Lip near its corner. Some make but one of this and the immediately fore-going; as alſo one other of the ſecond and third, but they are indeed diſtinct.

6. Conſtringens. And theſe are all of them Pairs, one on each ſide: but this which follows is ſingle, namely the *Orbicularis* or *Conſtringens*, and is common to both Lips. It is otherwiſe called *Oſculatorius*, becauſe it contracteth the Lips in Kiſſing. This is that which makes the proper figure and ſoft ſubſtance of both the Lips, encompaſſing the whole Mouth like a Sphincter, which by its orbicular Fibres it conſtringes or purſes up when one is ſaid to ſimper. It is cloſely knit to the skin of the Lips, through which it looks red when we are well, and pale when we are ſick. Some ſuppoſe this to be no Muſcle, but a ſpongy ſort of Fleſh, endued with no true muſcular Fibres, *viz.* ſuch as are capable of true muſcular Contraction. But I think there is reaſon enough to acknowledge it for a true Sphincter Muſcle, ſeeing the purſing up of the Mouth can be performed by none of the other Muſcles that belong to the Lips.

CHAP.

CHAP. VII.

Of the Muſcles of the lower Jaw.

The lower Jaw hath five Pair of Muſcles.

THE *lower Jaw* (for the *upper* is immoveable, and therefore has no Muſcles) is moved upwards, downwards, towards the right and left ſides, and backwards. For the performance of theſe motions *five* Pair of Muſcles are appointed, of which there is onely one Pair that draweth the Jaw downwards, all the others in ſome meaſure upwards, but chiefly the firſt Pair or Temporal. The reaſon why there is ſo ſlender a proviſion for pulling the Jaw down is, becauſe upon the relaxation onely of thoſe Muſcles that draw it up, its own gravity is ſufficient to make it fall down; but yet that that motion may be performed the more quickly and nimbly in chewing or ſpeaking, Nature has appointed one Pair of Muſcles to promote it.

1. Temporale.

The *firſt* Pair of the *Shutters* or drawers up is called *Temporale*, and is the ſtrongeſt and largeſt. It ſpringeth from the bones of the *Frons*, *Synciput* and Temples, and from *Os ſphenoides*, with a fleſhy, large and ſemicircular beginning, and on its outer ſide is covered with the *Pericranium*, its inner lying next the *Perioſteum*. Its Fibres the further they are from its middle, the more obliquely are they carried toward its Tendon, for the further it deſcends, the narrower (but thicker and more carnous) it grows; and at length paſſing under the *Os jugale*, it embraceth and is inſerted into the thin and broad Proceſs of the lower Jaw (called κορώνη) with a ſhort but very ſtrong Tendon.

Why the wounds of the temporal Muſcle are dangerous,

Spigelius ſays, this Tendon is extended through the whole Muſcle, in the midſt of its fleſhy ſubſtance. Whence it is, that if this Muſcle be wounded and inflamed, moſt bitter pains and dangerous ſymptoms enſue, partly becauſe the Tendon paſſeth ſo; partly becauſe it is covered with the *pericranium.* This Muſcle forcibly pulleth up the lower Jaw, and ſo ſhutteth the Mouth.

2. Maſſeter *or* laterale.

The *ſecond* is called *maſſeter*, becauſe it ſerveth for chewing by moving the Jaw to the right and left ſides: from its ſituation it may be called *laterale.* This hath two beginnings; one of which is nervous, large and ſtrong, ſpringing from the future, where the firſt bone of the Jaw is joyned to the fourth; the other fleſhy, proceeding from the *os jugale*, from whence marching towards the Chin, it is implanted into the whole breadth of the lower Jaw ſtrongly. The Fibres of this Muſcle, by reaſon of its two beginnings, croſs one another; ſo that it does not only move the Jaw laterally, but backward and forwards alſo: upon which account ſome eſteem it a double Muſcle.

3. Aliforme externum, *or* maxillam abducens.

The *third* pair is called *pterygoideum* (or *aliforme*) *externum*, or *maxillam abducens.* This hath alſo a double beginning, partly nervous and partly fleſhy; ſpringing partly from the upper external ſides of the wing-like proceſs of the *os ſphenoides*, partly from the rough and ſharp line of the ſame bone. Whence marching down with ſtreight Fibres, it becometh greater and thicker. And at length is inſerted by a ſtrong Tendon into the inſide of the *condyloides* proceſs of the lower Jaw, under the Tendon of the temporal Muſcle. This moveth the Jaw forward, whereby by the Teeth of the lower Jaw are made to ſtand further out than thoſe of the upper.

4. Aliforme internum, *or* maxillam adducens.

The *fourth* pair is termed *maxillam adducens*, or *pterygoideum internum.* This draweth the Jaw towards its head, or backward. This, in the beginning being nervous, doth ſpring from the inner cavity of the wing-like proceſs of the *os ſphenoides*; then becoming fleſhy, large and thick, and marching down by a ſtreight paſſage, it is inſerted into the inner and hinder part of the lower Jaw by a nervous, broad and ſtrong Tendon. Beſides its more proper action of drawing the Jaw backwards, it alſo helps the temporal Muſcle to draw it up, and ſo do the ſecond and third pair in ſome meaſure, wherefore we rank all theſe four amongſt the *Shutters.*

5. Deprimens, *or* biventre.

The *fifth* and laſt pair *opens* the Mouth by pulling down the Jaw, whence it is called *Deprimens*, and otherwiſe *digaſtricum* or *biventre*, becauſe it hath two bellies. Anatomiſts commonly reckon this for the ſecond pair of the Movers of the lower Jaw, but ſeeing it has a diſtinct office from the other four, we have plac'd it laſt. It has its beginning from the *Styloides* proceſs of the Temple-bone, where it is nervous and broad; and afterwards becoming fleſhy, ſmall and round, it paſſeth downward, and in its middle where it cometh to the flexure of the lower Jaw-bone, it loſeth its fleſhy ſubſtance, and degenerates into a nervous and round Tendon; but by and by it becomes carnous again, and going along the inner ſide of the lower Jaw is inſerted into its forepart under the Chin. It loſeth its fleſhy ſubſtance and becomes tendinous in its middle, that it may give way to the Jugular Vein aſcending in that place. This Muſcle, as hath been ſaid, draws down the

Jaw, in which action ſome think it is partly aſſiſted by the *par quadratum* deſcribed in the foregoing Chapter.

CHAP. VIII.

Of the Muſcles of the Ear.

THE *Ear* conſiſts of an *outer* and an *inner* part; and each has its proper Muſcles.

The *outer* part is moved but very obſcurely, becauſe in Men the Muſcles are exceeding ſmall; ſo that *Galen* calls them, only lineaments or reſemblances of Muſcles. There are commonly reckoned *four* of them, which by their ſituation ſeem fit to move this *outer* part of the Ear (called *auricula* by *Spigelius*, to diſtinguiſh it from the *inner* part called *auris*) four manner of ways.

The auricula *hath four Muſcles.*

1. The *firſt* is called *attollens*. This ariſes at the outer edge of the frontal Muſcle (where it is contiguous to the temporal) with a thin and membranous beginning; and in its deſcent lies upon the temporal Muſcle, by degrees becoming narrower, and is inſerted into the upper part of the Ear, which it moveth upwards and forwards.

2. The *ſecond* is called *detrahens*. This ariſeth broad and carnous from the mammillary Proceſs, and growing narrower is inſerted into the root of the Cartilage of the Ear, ſometimes by two, ſometimes by three Tendons. It draweth the Ear upwards and backwards.

3. The *third* is called *adducens ad anteriora*, whereby the Ear is drawn forward and downward. This is but a particle of the *Muſculus quadratus*, that pulleth down the Cheeks, deſcribed before, which aſcending with its Fibres, is implanted into the root of the Ear.

4. The *fourth* is *abducens ad poſteriora*, which draws the Ear backward. This hath its beginning in the back-part of the Head, from the Tunicles of the Muſcles of the *occiput*, above the *proceſſus mammillaris*, where it is narrow, but waxing broader it is carried downward tranſverſly, and is inſerted into the Ear behind. All theſe Muſcles in Horſes, Oxen and the like, are very large to what they are in Men, (yea they have more than theſe) whereby they can move their Ears more ſtrongly and apparently, to ſhake off Flies or any thing that offends them.

Monſ. *du Verney* only reckons two Muſcles of the Auricle, the firſt of which, he ſays, is made up of certain carnous Fibres ariſing from that part of the *pericranium* that covers the Temporal Muſcle, from whence deſcending in a ſtreight line it inſerts it ſelf into the upper and back-part of the *Concha*. The ſecond, he ſays, likewiſe conſiſts of five or ſix carnous Fibres, that take their riſe from the upper and foremoſt part of the proceſs *Maſtoides*, and deſcending obliquely for about an inch terminate at the middle of the *concha*.

The auris *three.* In the *inner* part of the Ear (called *Auris*) there are three. The firſt is called *externus*. It is ſmall, 1. ſpringing pretty broad from the upper part of the *meatus auditorius*; then becoming narrower it grows into a very fine and ſmall Tendon, which being carried contiguous to the *tympanum*, is inſerted into the longer proceſs of the *malleus*. The handle of which *malleus* adhering to the *tympanum*, when the *malleus* is moved by this Muſcle, the *tympanum* is ſo alſo, both of them being drawn a little outward and upward.

2. The *ſecond* is called *internus*. This is very ſmall, and is placed within the *os petroſum*. It hath its beginning in the *baſis* of the wedge-like bone, there where it is joyned with the *proceſſus petroſus*, and at about its middle it is divided into two ſmall Tendons, whereof the one is inſerted into the ſhorter proceſs of the *malleus*, and the other into the neck or handle of it. This draws the head of the *malleus* obliquely forward, and pulls it inward from the *incus*, and together with the *malleus*, it draws the *tympanum* alſo inwards to which the handle of the *malleus* is affixt.

3. Theſe two *du Verney* reckons for Muſcles of the *Malleus*, and he deſcribes a *third* belonging to the *Stapes*, which (I think) no former Anatomiſt hath obſerved. He ſays, it is hid within a quill-like cavity formed in the *os petroſum* almoſt at the bottom of the barrel, from whence it takes its riſe. Its belly is thick and carnous, and in a little ſpace it ends in a very looſe Tendon, which inſerts it ſelf into the head of the *Stapes*. The cavity which contains the belly of the Muſcle is about the ſixth part of an inch long, and is much wider than the hole by which the Tendon of the Muſcle paſſes.

CHAP. IX.

Of the Muſcles of the Tongue.

THE *Tongue* being the chief Inſtrument of Speech, and a part which ſerves to roll the Meat in the Mouth this way and that way, has all manner of motions, being moved forward and backward, upward and downward, to the right hand and to the left; it is alſo ſtretched out broad, or contracted. Its Muſcles are either *proper* to it ſelf, or *common* to it with the *os hyoides* (to be deſcribed in the next Chapter.)

The Tongue has five pair.

1. It has *five* pair of *proper* Muſcles. The *firſt* is *genioglosſum*, ſo called from its riſe and inſertion (γένειον the *Chin*, and γλῶσσα the *Tongue*) as moſt of the reſt are. This pulleth the Tongue forward without the Teeth and Lips. It ſpringeth from that rough part of the lower Jaw-bone which is in the middle of the Chin, in the inner and lower ſide of it; and is inſerted into the lower ſide, and towards the root of the Tongue.

2. The *ſecond* is called *Ypſiloglosſum* (on the ſame account.) It ariſeth from the middle and upper part of the *os hyoides* or *ypſiloides*, and ends in the middle of the Tongue, which it draws ſtreight backwards or inwards.

3. The *third* is called *Myloglosſum*. This ſpringeth from the inner part of the lower Jaw, where the fartheſt *grinding Teeth* are, (whence it has its name) and is inſerted into the Ligament by which the Tongue is tied to the *fauces*. Authors differ about the uſe of this pair; ſome thinking that it

draws the Tongue downward; others, that if both of them act together, they draw the tip of the Tongue ſtreight upward and backward to the Palate and upper Teeth; if but one, that it draws it obliquely upward towards its own ſide.

4. The *fourth* is called *Ceratogloſſum*, becauſe it ariſeth from the *horn* of the *Os hyoides*. It is inſerted into the ſide of the Tongue. If both of theſe be contracted at once, they draw the Tongue ſtreight downward and inward; but if only one, then is the Tongue drawn obliquely to that ſide.

5. The *fifth* pair is called *Stylogloſſum*, becauſe it ariſeth from the *ſtyloides proceſſus* of the Temple-bone; from which ſpringing fleſhy and ſmall, but afterwards becoming broader and thicker, it is inſerted into the ſide of the Tongue, at about the middle of its length. If both theſe act together, they pull the Tongue upward and inward; but if one only, then to the right hand or to the left.

CHAP. X.

Of the Muſcles of the Bone of the Tongue, called Os Hyoides.

THis Bone is moved upwards, downwards, forward, backward, and towards the ſides, as the Tongue is; for ſeeing it is fixed to the root of the Tongue, they muſt needs accompany one the other in their motions; ſo that the Muſcles that are inſerted into this bone, moving the Tongue alſo, they are eſteemed *common* to both.

To perform theſe motions it hath *four* pair of Muſcles. The *firſt* is called *Sternohyoideum.* This ſpringing from the upper, but inner part of the *ſternum* with a broad and carnous beginning, and aſcending under the Skin of the Neck by the Wind-pipe, ſtill keeping the ſame largeneſs and ſubſtance, is inſerted in the root or *baſis* of the *hyoides*, which it moveth (and the Tongue with it*)* downward and backward. Os hyoides *hath four pair.* 1.

The *ſecond* is oppoſite to this, and is called *geniohyoideum.* This ſpringing from the inner part of the Chin, (by the *genioglоſſum)* fleſhy and broad, is inſerted into the upper part of the *baſis* of the Bone, where a cavity is made to receive its Tendon, and draweth it ſtreight upwards and a little forwards. 2.

The *third* is called *Coracohyoideum.* It ariſeth from the upper ſide of the *Scapula* near the *Coracoides proceſſus*, having a carnous beginning, and lurking under the *Levator* of the Shoulder-blade, called *Muſculus patientiæ*, it aſcends under the *par maſtoides* that bends the Head, where it loſeth its fleſhy ſubſtance, and degenerates into a nervous and round Tendon. But as ſoon as it is paſt this, it becomes carnous again, and ſo continues till it is inſerted into the horns of the *Os hyoides.* Conſidering its ſlenderneſs it is the longeſt Muſcle of the Body, and has two Bellies like the *par deprimens* that pulls down the lower Jaw. The reaſon of its becoming tendinous in the middle, *Spigelius* thinks to be, that it may make way for the *par maſtoides*, as being more worthy than it ſelf: but Dr. *Croone* is of opinion, that the reaſon is, that it may give way to the *Carotides* aſcending under it. Its office is to pull the Bone obliquely downwards. 3.

The

4. The *fourth* is *ſtyloceratohyoideum.* This riſeth from the root of the *proceſſus ſtyloides*, and endeth in the root of the horn of the *Os hyoides*, which it draweth obliquely upward.

CHAP. XI.

Of the Muſcles of the Larynx.

The Larynx *hath two pair of common Muſcles.*

THE *Larynx* conſiſts of four Cartilages (beſides the *Epiglottis*) of which we have treated in Book II. Chap. 14. of theſe only three are moveable, *viz.* the *Thyreoides* or Buckler-like, which is one, and the *Arytænoides* or Ewer-like which are two. By theſe latter is the *Rimula* of the *Glottis* formed, for the widening and ſtraitning, or opening and ſhutting whereof the Muſcles of the *Larynx* ſerve. Theſe are divided into *common* and *proper*. The common ſpring from other parts, but are inſerted into one of the Cartilages; the proper both ariſe from and are inſerted into them. The *common* are *two* pair, viz. *hyothyreoideum* and *ſternothyreoideum.*

1. The *Hyothyreoideum* ſpringeth from the whole *baſis* almoſt of the Bone of the Tongue, having a broad and carnous beginning; from whence deſcending with ſtreight Fibres, and covering all the outſide of the Cartilage *Thyreoides*, it is inſerted into its under-ſide. When this is contracted, it draws the buckler-like (or *thyreoides*) Cartilage upwards and inwards, and thereby ſtraiteneth the Chink of the *Larynx.*

2. The *Sternothyreoideum* ariſeth from the upper and inner-part of the *ſternum* with a carnous and

broad beginning, from whence aſcending with ſtreight Fibres up by the ſides of the Wind-pipe, (continuing the ſame largeneſs and ſubſtance) it is at laſt inſerted into the lower ſide of the buckler-like Cartilage, by drawing down which it opens or widens the Chink. *Diemerbroeck* aſſigns clear contrary actions to theſe Muſcles, *viz.* that the former widens, and this latter ſtraitens the *Rimula* of the *Larynx.*

Five pair of proper. The *proper* are *five* pair, (or only nine Muſcles as ſome reckon, eſteeming the fifth pair to be a ſingle Muſcle.) The *firſt* pair is called *Cricothyreoideum anticum.* This ſpringeth from the fore-part of the *Cricoides* or ring-like Cartilage, (*viz.* that which is immoveable) and is inſerted into the lateral parts of the *Thyreoides*, which it moves forwards, and ſo widens the *Rimula*, for the forming of a big voice. *Bartholin*, from the inſertion of the Nerve, ſays, it ariſes from the *Thyreoides*, and is inſerted into the *Cricoides.* Alſo if this pair be very broad, he ſays, it may be divided into two pair, (which *Riolanus* has done) and then the ſecond may be called *Cricothyreoideum laterale.* 1.

The *ſecond* pair, which is called *Cricoarytænoidcum poſticum*, ſpringeth carnous from the hinder and lower part of the *Cricoides*, and aſcending with ſtreight Fibres is inſerted with a nervous end into the lower ſide of the *Arytænoides*, ſerving to pull its two Cartilages ſideways, and thereby to open and widen the *Larynx.* 2.

The *third* is *Cricoarytænoideum laterale*, which ſpringeth from the ſide of the *Cricoides*, where it is broadeſt, with a ſlender beginning, but growing preſently larger, it is implanted into the ſide of the *Arytænoides*, in that part that the foregoing 3.

did not cover. This openeth the *Larynx* by drawing the Cartilages obliquely aſide, and ſo aſſiſteth the action of the former.

4. The *fourth* pair is called *Thyreoarytænoideum.* This is internal, carnous and broad, ariſing from the fore interiour part of the *Thyreoides*, and is inſerted into the ſide of the *Arytænoides*, whoſe cartilages it draws the one towards the other, and ſo ſtraitens the *Larynx*.

5. The *fifth* and laſt is reckoned by ſome for a pair, and by others but for one Muſcle. It is called *Arytænoides*, becauſe it has its riſe from and inſertion into the Cartilage ſo called. Its riſe is at the hinder Line of the Cartilage, from whence being extended with tranſverſe Fibres, it is inſerted into the ſide of the ſame, and by conſtringing of it ſtraitens the *Larynx*.

Theſe are the Muſcles that perform the motions of the *Larynx*; but as to the uſe of each particular, Authors diſagree very much. Dr. *Croone* gives this general rule to underſtand their uſes, That thoſe which lie on the foreſide of the *Larynx*, ſerve to open or widen the *Rimula*; and thoſe which lie on the hinder-ſide, to ſtraiten or ſhut it. To whoſe Opinion great deference is owing.

As for the *Epiglottis*, which is reckoned for the fifth Cartilage of the *Larynx*, though in ſome Brutes it have Muſcles, yet Anatomiſts generally agree that in Man it has none, nor is moved with a voluntary motion, but is only depreſſed by the weight of what is ſwallowed, and by the drawing of the Tongue backward or inwards; which motion being over, the *Epiglottis* ſtands up again in its natural and proper poſture, and ſo opens the *Larynx*.

CHAP.

CHAP. XII.

Of the Muſcles of the Uvula, *Palate and Throat.*

The Uvula *ſaid to have two Pair of Muſcles.*

THE *Uvula* is ſaid by *Veſlingius*, *Riolanus*, *&c.* to have two Pair of Muſcles to hold it up; of which one is called *Pterygoſtaphilinum externum*, which ſpringeth from the upper Jaw, a little below the furthermoſt Grinder, and is inſerted into the ſide of the *Uvula:* the other *Pterygoſtaphilinum internum*, proceeding from the lower part of the internal wing of the *pterygoides Proceſſus*, and inſerted into the *Uvula* in like manner. But theſe Muſcles are very hard to diſcover: and indeed there ſeems no occaſion for them, ſeeing the *Uvula* has no apparent motion, and its own frame ſeems ſufficient to ſuſpend it.

The Palate hath one Pair.

From the aforeſaid wing-like Proceſs (of the *Os cuneiforme)* does there another Pair of Muſcles ariſe, firſt found out by Dr. *Croone*, and by him called *Pterygopalatinum.* Its Inſertion is into the Roof of the Mouth by the ſide of the palatine Gland (deſcribed in Book III. Chap. *ult.* from *Steno.)* Its Uſe is very obſcure; but perhaps in ſtrong hawking it may ſerve to compreſs the ſaid Gland a little, and to ſqueeze out of it ſome of that humour that is ſeparated in it.

The Throat hath three Pair and a Sphincter.

The *Throat*, or the beginning of the *œſophagus*, called *pharynx*, hath ſeven Muſcles, to wit, *three* Pair and a *Sphincter.*

1. Of the Pairs, the *firſt* is *Sphenopharyngæum.* This ſpringeth from the ſharp point of the *Os ſphenoides* with a ſmall and nervous beginning, and paſſing downward, ends in a fine Tendon, which is inſerted obliquely into the lateral part of the Palate and *Pharynx*, which it widens in ſwallowing.

2. The *ſecond* pair is called *Cephalopharyngæum*, and ſpringeth from that part where the Head is joyned to the firſt *Vertebra* of the Neck; from whence marching down, it is ſpread about the *Pharynx* with a large *plexus* of Fibres, and ſeemeth to make its Membrane. This ſtraitens the Throat in ſwallowing.

3. The *third* is *Stylopharyngæum*. This ſpringing from the *Styloides* Proceſs of the Temple-bone, is inſerted into the ſides of the *Pharynx* to dilate it.

4. That Muſcle which hath no fellow is called *Oeſophagiæus*. This ariſes from one ſide of the *Thyreoides* Cartilage, and circularly encompaſſing the *Pharynx* with tranſverſe Fibres, is inſerted into the other ſide of the *Thyreoides*; and ſerves to contract the Mouth of the Gullet, as the *Sphincters* of the *Anus* and Bladder do thoſe parts.

CHAP. XIII.

Of the Muſcles of the Head.

The Muſcles of the Head are common or proper.

THE Muſcles of the *Head* are either *common*, or *proper*. The *common* are thoſe which move the Head together with the Neck, which are to be deſcribed in the next Chapter.

The *proper* are thoſe which only move the Head, the Neck remaining unmoved, and theſe are in number ſixteen, or eight pair, and move it either forward or backward, to one ſide or the other, or about.

The proper are eight pair.

1. The *firſt* pair, called *Maſtoideum*, bend the Head forward, if both act together; but on one ſide obliquely, if but one. Theſe have each a double beginning; one nervous from the top of the *Sternum*, the other carnous from the upper ſide of the *Clavicula*; which Origines joyning, it becomes wholly carnous, and aſcending obliquely by the Neck, at laſt is inſerted with a carnous end into the Mammillary (or *maſtoides*) proceſs of the Temple-bone. This is the only pair that is placed in the forepart, and bows the Head forward; all the reſt are ſeated behind, of which the five next bend it backwards if both act, (which is called extending of the Head) or a little ſideways if but one; and the two laſt ſerve to turn it about.

2. The *ſecond* pair is called *Splenium* or *Triangulare*. It riſes with a nervous beginning from the Spines of the five uppermoſt *Vertebræ* of the *Thorax*, and of the five lowermoſt of the Neck; from whence aſcending and becoming thick and carnous, it is implanted into the *Occiput* with a broad and fleſhy end.

3. The *third* is called *Complexum* or *Trigeminum*, becauſe it has ſo plainly a *threefold* beginning, that it ſeems to be a compound of three Muſcles. *One* beginning is from the tranſverſe Proceſſes of the fourth and fifth *Vertebræ* of the *Thorax*, a *ſecond* from thoſe of the firſt and ſecond of the ſame, and a *third* from the Spine of the ſeventh *Vertebra* of the Neck: All which in their aſcent be-

ing united into one, are inſerted into the *Occiput* ſometimes by one, and ſometimes by a triple Tendon.

4. The *fourth* pair is called *Parvum & craſſum*, becauſe it is but a *little* one, yet pretty *thick.* This lieth under the third pair. It ariſes nervous from the tranſverſe Proceſſes of the ſix uppermoſt *Vertebræ* of the Neck, and is inſerted into the hinder root of the Mammillary Proceſs.

5. The *fifth* pair is *Rectum majus.* Theſe ſpringing from the tip of the Spine of the ſecond *Vertebra* of the Neck, are inſerted into the *Occiput.*

6. The *ſixth*, *Rectum minus.* Theſe lie under the former, and proceeding from the back-part of the firſt *Vertebra* end into the *Occiput.*

Theſe five laſt ſerve all to bow the Head backward or extend it: the two following turn it about, as was obſerved before.

7. The *ſeventh* is *Obliquum ſuperius.* This pair lies under the two *Recta*, anſwering to them in ſubſtance and form. It ſprings from the tranſverſe Proceſs of the firſt *Vertebra* of the Neck, and is implanted into the *Occiput* by the outer-ſide of the *Recta.* Some ſay its riſe is here, and its inſertion into the *Vertebra.*

8. The *eighth*, *Obliquum inferius.* This riſes from the Spine of the ſecond *Vertebra* of the Neck, and is inſerted into the tranſverſe Proceſs of the firſt *Vertebra* of the ſame. So that having both its riſe and inſertion in the Neck, it might juſtly be reckoned for a Muſcle thereof, and ſo ſhould have been deſcribed in the next Chapter: but we have ranked it amongſt thoſe of the Head, partly from the authority of moſt Anatomiſts who generally have done ſo, and partly becauſe the firſt *Vertebra*

Vertebra into which it is inſerted, always follows the motion of the Head, as ſhall be ſhewn in the next Book, Chap. 10. Of the uſe of theſe two laſt pairs we have ſpoken already.

CHAP. XIV.

Of the Muſcles of the Neck.

The muſcles common to the head and neck are four pair.

THE *Head* is not only moved by the *proper* Muſcles aboveſaid primarily, but ſecondarily alſo by theſe of the *Neck*, which are therefore called *common*, and are eight in number, on each ſide four. The firſt and ſecond pair bend the Neck and together with it the Head directly backward, or obliquely; the third and fourth directly forward, or to one ſide, as both or one act.

The *firſt* is called *Spinatum.* This proceeding from the roots of the *Spinæ* of the ſeven upper *Vertebræ* of the *Thorax*, and of the five loweſt of the Neck, is inſerted ſtrongly into the whole lower ſide of the Spine of the ſecond *Vertebra* of the Neck. 1.

The *ſecond*, *Tranſverſale.* This riſing from the tranſverſe Proceſſes of the ſix upper *Vertebræ* of the *Thorax*, is inſerted into the out-ſide of all the tranſverſe Proceſſes of the *Vertebræ* of the Neck. 2.

The *third*, *Longum.* This being placed behind the *Oeſophagus*, doth ſpring from the bodies of the fifth and ſixth *Vertebræ* of the *Thorax*, and as it aſcends is knit to the ſides of the bodies of all the *Vertebræ*, till it come to the firſt or higheſt of the 3.

Neck, where each touching other they are both inſerted into its Proceſs, which anſwers to the body of the other *Vertebræ*.

4. The *fourth*, *Triangulare*, or *Scalenum*. It proceeds carnous from the firſt rib, and is inſerted into the inſide of all the tranſverſe Proceſſes of the Neck, except ſometime the firſt and ſecond. It is perforated to make way for the Veins and Arteries which paſs to the Arms. The uſes of all theſe pairs were ſhewn at the beginning of the Chapter.

CHAP. XV.

Of the Muſcles of the Thorax.

Having done with the Muſcles that belong to the Head, the higheſt *Venter*, we come now to thoſe of the middle or *Thorax* which aſſiſt Reſpiration. Of theſe ſome dilate the Breaſt in Inſpiration, ſome contract it in Expiration.

The Dilaters.

1. Of the *Dilaters*, the *firſt* is called *par Subclavium.* This ariſeth fleſhy from the inſide of the *Clavicula* near the Shoulder-point, and paſſing obliquely (or almoſt tranſverſly) is inſerted into the firſt Rib, near to the *Sternum*.

2. The *ſecond* is *Serratum majus anticum.* This ariſes from the inſide of the *baſis* of the Shoulder-blade, and the two uppermoſt true Ribs, and is inſerted into the five loweſt true Ribs, and two uppermoſt baſtard Ribs, before they end into Cartilages. It is called *Serratum* or Saw-like, becauſe its unequal *extremities* being intermixed with the like unequal *beginnings* of the obliquely

deſcending Muſcle of the *Abdomen*, imitate the Teeth of a *Saw*.

3. The *third* is *Serratum poſticum ſuperius.* This lying under the *Rhomboides*, (or fourth Muſcle of the *Scapula*) ſpringeth membranous from the Spines of the three loweſt *Vertebræ* of the Neck, and of the firſt *Vertebra* of the Back, and is inſerted into the three or four uppermoſt Ribs.

4. The *fourth* is *Serratum poſticum inferius.* This ariſeth from the Spines of the three loweſt *Vertebræ* of the Back, and of the firſt of the Loins, and is inſerted into three or four of the loweſt (ſhort) Ribs.

5. *Fifthly, The eleven external Intercoſtals*, which perform the office but of one Muſcle. Theſe ſpring from the lower part of the upper Rib, and are inſerted into the upper part of the lower Rib obliquely.

There is another Muſcle beſides theſe, that aſſiſts the widening of the Breaſt, namely the *Diaphragm*: but of it we ſpoke at large in *Book* II. *Chap.* 3. where the Reader may find its Deſcription and Uſe.

The Contracters.

1. Theſe that follow *contract* the Breaſt. *Firſt*, the *par triangulare.* This ariſing from the middle Line of the *Sternum*, is inſerted into the bony ends of the third, fourth, fifth and ſixth true Ribs, (where they are joyned to the Cartilages.) *Steno* ſays, its riſe is from the *Sternum*, and inſertion into the Ribs.

2. The *ſecond* is *Sacrolumbum.* This ariſeth from the edge of *os Ileum*, the upper part of *os ſacrum*, and the Spines of the *vertebræ* of the Loins; and aſcending up to the Ribs, is implanted into each of them in their lower ſide, about three Fingers breadth from the Spine, by a particular Tendon,

(*Diemerbroeck* deſcribes another pair oppoſite to this (which he calls *cervicale deſcendens*) ſpringing from the third, fourth, fifth, ſixth and ſeventh *vertebra* of the Neck, and is inſerted into the upper ſide of each Rib as the *Sacrolumbum* is into the lower. And ſays, that this pair by pulling the Ribs upwards in inſpiration widens the Breaſt, as the other by drawing them down in expiration ſtraitens it.) 3. *Thirdly*, *The eleven internal Intercoſtals*, which are as one Muſcle. Theſe paſs obliquely from the lower to the upper Rib. Their Fibres run a contrary courſe to thoſe of the external, croſſing of them like the ſtrokes of the Letter X.

The uſe of the intercoſtal Muſcles.

I place the *Internal* Intercoſtals among the Contracters of the Breaſt, as alſo the *External* among the Dilaters, becauſe moſt Anatomiſts have done ſo; though ſome there are that think the internal dilate it, and the external contract it. Yea, Dr. *Mayow* is of opinion, that they both of them dilate it. For going upon this ſuppoſition, That the *Thorax* is widened by drawing the Ribs upward, he thinks them both equally adapted for that action. For ſeeing in all muſcular motion the part that is leſs firm, is moved towards that which is more firm, and that each lower Rib ſucceſſively is joynted looſer than that immediately above it, it muſt needs be, that the internal upon their contraction draw the Ribs upwards as well as the external, and that not obliquely, but directly. For by their croſſing one another they hinder the *obliquity* of one anothers motion (for which each ſeverally is fitted) and ſo perform the ſame motion as if their Fibres deſcended *ſtreight* from the upper Rib to the lower; which courſe of Fibres was not convenient here, becauſe of the ſmall ſpace betwixt one Rib and another, which would not permit them to have that length which the nature of Muſcles requires.] Thus that ingenious perſon diſcourſes, I think very probably.

Theſe Muſcles of Reſpiration are much aſſiſted in their action, ſecondarily, by the Muſcles of the *Abdomen*, *ſcapulæ* and Arms, which ſhall be deſcribed in their proper Chapters.

CHAP. XVI.

Of the Muſcles of the Back and Loins.

THE *Back*, but eſpecially the *Loins*, being moved diverſly, *viz.* backward and forward and to the ſides, into every *Vertebra* there are Tendons of Muſcles inſerted, as if there were a great many Muſcles in all. But there are but four (proper) pair to aſſiſt the motion of both.

The back and loins have four pair.

The *firſt* pair are two triangular Muſcles, which being joyned together make a kind of a quadrature, and are therefore called *par quadratum.* Theſe ariſe broad and thick from the hinder upper cavity of *Os Ileum*, and the inner ſide of *os Sacrum*, and are inſerted into the tranſverſe Proceſſes of the *Vertebræ* of the Loins even up to the loweſt Rib. If both theſe act together, they bow the *Vertebræ* of the Loins ſtreight forward; if one alone, obliquely forward. 1.

The *ſecond* and principal pair are the *Muſculi longiſſimi.* This ſprings from all the Spines of *Os ſacrum* and of the *Vertebræ* of the Loins, and alſo from 2.

from the inſide of *Os Ileum* where it is joyned to the *Sacrum*; from whence it aſcends all up the Spine, and terminates in the *proceſſus mammillaris* of the Temple-bone, in its way lying upon the tranſverſe proceſſes of the Lumbar *Vertebræ*, and beſtowing Tendons on the tranſverſe Proceſſes of all the *Vertebræ* of the Back, (whence ſome have divided this Muſcle into as many as there are *Vertebræ*.) It is almoſt confounded with the two following from its riſe till the loweſt *Vertebra* of the *Thorax*, where it begins to be ſeparated from them and leaves them. But ſo far as they accompany it, it is ſo very difficult to ſeparate and diſtinguiſh them, that ſome account all three but for one.

3. The *third* pair are the Muſcles called *Sacri*. This ariſes behind from the *Os ſacrum*, with an acute and fleſhy beginning, and ends in the Spine of the loweſt *Vertebra* of the *Thorax*, and for the moſt part alſo is inſerted, by the way, into the Spines and oblique Proceſſes of the *Vertebræ* of the Loins. This helpeth the action of the former.

4. The *fourth* and laſt pair are the *Semiſpinati*. This ſprings by a nervous beginning from all the Spines of *Os ſacrum* and the Loins, and ends in the tranſverſe Proceſſes of the *vertebræ* of the Loins, and of the lowermoſt of the *Thorax*. *Spigelius* ſays, it ariſes from the Spine of the loweſt *vertebra* of the Back, and ends in the Spine of the firſt; by the way beſtowing Tendons on all the *Spines*, as the *Longiſſimi* did on the *tranſverſe* proceſſes. Others deſcribe it otherwiſe. The truth is, it is ſo almoſt impoſſible to ſeparate and raiſe theſe Muſcles of the Back and Loins, that 'tis no wonder Authors differ ſo much in their number and deſcription.

But how many ſoever they be, or whereſoever be their riſe and inſertion, the uſe of them all is to erect the Trunk of the Body by bending the Back and Loins backward, except the firſt pair which bow it forward, in which action they are much aſſiſted by the *Recti* of the *Abdomen*, which we ſhall deſcribe in the next Chapter.

CHAP. XVII.

Of the Muſcles of the Abdomen.

IN the firſt *Book*, *Chap.* 3. where we diſcourſed of the *common containing* parts of the *Abdomen*, or loweſt Venter, we only barely mentioned its Muſcles, deferring the deſcription of them till this place, where it ſeems more proper.

The Abdomen *hath five pair.* The *Abdomen* then hath ten Muſcles, five on each ſide. The *firſt* pair is *Obliquè deſcendens*. 1. It ſpringeth from the lower ſide of the ſixth, ſeventh, eighth, ninth, tenth and eleventh Ribs, (before they paſs into Cartilages) by ſo many diſtinct acute beginnings: and each preſently ſpreading it ſelf, in a ſhort ſpace they grow into one Muſcle. Theſe ſeveral beginnings appear ſomewhat like the Teeth of a Saw, and are intermixed with the Saw-like Tendons of the *Serratus major anticus* of the Breaſt, as when one thruſts the Fingers of one Hand betwixt thoſe of the other. Beſides theſe Origines, it is ſaid alſo to ſpring from the tranſverſe Proceſſes of the Lumbar *vertebræ*: but Dr. *Croone* thinks that to be a miſtake, becauſe thoſe Proceſſes are ſo covered with other Muſcles, eſpecially with the *Latiſſimus dorſi*, that this can by no means ſpring therefrom. Wherefore he aſſigns to it in this place another origin, namely from the inveſting Membrane of the ſaid *latiſſimus*, as he does alſo to the following pair, who have been alſo ſaid to ariſe from the ſaid Proceſſes. Laſtly, it ſprings from the upper edge of *Os Ileum*; from all which places its Fibres deſcend obliquely forward, and it endeth by a broad Tendon in the middle of the Belly in the *Linea alba*; which Tendon cleaves ſo faſt to that of the obliquely aſcending (lying next under this) that they cannot be ſeparated without tearing. The *Linea alba* in which theſe Tendons end, is a white part or Line running from the *Mucronata cartilago* at the pit of the Stomach, down the middle of the Belly by the Navel to the *Oſſa pubis*, and is made of the concourſe of the Tendons of the Muſcles of the *Abdomen*; namely of this pair already mentioned, and of the *Obliquè aſcendens*, the tranſverſe and pyramidal.

Linea alba.

2. The *ſecond* is the *Obliquè aſcendens*. This lies next under the former, and its Fibres aſcending obliquely croſs thoſe of the other like an X. It ſprings from the tranſverſe proceſſes of the *vertebræ* of the Loins, (as hath hitherto been taught, but Dr. *Croone* ſays, from the inveſting Membrane of the *latiſſimus dorſi*) and the Spines of *Os ſacrum* with a membranous beginning, and from the edge of *Os Ileum* with a fleſhy. Aſcending carnous from hence it is joyned to the Cartilages of the eighth, ninth, tenth and eleventh Ribs, and ends in the *linea alba* with a broad and nervous Tendon.

Note, That the Tendons of both theſe oblique Muſcles, (as alſo thoſe of the tranſverſe) are perforated in the bottom of the *Abdomen* for the deſcent of the Spermatick veſſels into the *Scrotum.*

The *third* pair is the *Rectum* or ſtreight. This arifes fleſhy from the lower part of the *Sternum*, from the ſide of the *Cartilago mucronata*, and from the Cartilaginous ending of four Ribs; and ſo marching ſtreight down along the Belly, it is inſerted by a ſtrong Tendon into the *Os pubis.* It hath ſometimes three, ſometimes four tranſverſe inſcriptions or interſections, that appear tendinous: whence ſome divide each Muſcle into four or five Muſcles, accordingly as they have three or four interſections. And indeed if *Galen*'s Rule be true, that whereſoever the Nerve is inſerted into the Muſcle, *there* is its head: we muſt confeſs they are diſtinct Muſcles. For Nerves are inſerted into both their upper and lower parts, and into each of thoſe that lye betwixt the Interſections. And by ſuppoſing them thus diſtinct, we may conceive how they may better perform their primary action, which is ſtrongly to compreſs the Belly for the expulſion of the *fæces* or *fœtus.* Under theſe Muſcles do the *Arteriæ* and *Venæ mammariæ* deſcend to about the Navel, as the *Arteriæ* and *Venæ epigaſtricæ* aſcend under them to near the ſame place; and theſe were held to inoſculate one with another, (the deſcending with the aſcending) till of late that ſuch inoſculation is diſcovered to be meerly imaginary. 3.

The *fourth* pair is the *pyramidal.* Theſe Muſcles are ſeated upon the lower part of the *Recti*, ſpringing carnous from the *Oſſa pubis* into which the *Recti* are inſerted. They are broader at their *baſis*, and in their aſcent grow narrower and narrower till they end in an acute Tendon, which is 4.

inſerted into the *linea alba*, and reaches ſometimes as high as the Navel, though their carnous part be but about an hands breadth long. They are ſaid to aſſiſt the *Recti* in their action, and are for that reaſon called otherwiſe *Succenturiati*. But they ſeem to ſome more particularly to ſerve to compreſs the Bladder in making Water; though conſidering the ſhortneſs of their carnous part, and their external ſituation, 'tis difficult to conceive how they can much aſſiſt that action, which moſt probably is chiefly performed by the proper muſcular Fibres of the Bladder it ſelf, but perhaps may be ſomewhat promoted by all the Muſcles of the *Abdomen* as well as this, while they conſtringe the Belly and ſo preſs the Guts againſt the Bladder; which preſſure is remotely owing alſo to the Muſcles of the *Thorax*, eſpecially the Diaphragm. Sometimes one, and ſometimes both of theſe pyramidal Muſcles are wanting, and then the ending of the *Recti* is broader and more carnous.

5. The *fifth* pair is the *tranſverſe*. Theſe cleave cloſe to the *Peritonæum* on their inſide: and they are called *tranſverſe*, becauſe their Fibres run croſs or athwart the Belly. They ſpring from a Ligament that grows from the tranſverſe proceſſes of the *vertebræ* of the Loins, from *os Ileum*, and the inſide of the cartilaginous ends of the baſtard Ribs, and end in a broad and membranous Tendon in the *linea alba*.

Their uſe. The *uſe* of all theſe Muſcles hath been held to be *firſt*, when they act not, to defend the *viſcera* contained under them from external injuries, and to encreaſe their heat: and *ſecondly*, when they are in action, firſt to further the excretion of the Excrements; ſecondly, to help the excluſion of the Infant in labour; thirdly, to aſſiſt the Breaſt in ſtrong expiration and expectoration; and fourthly, to help to bend the Trunk of the Body forward in ſtooping, which is chiefly done by the *Recti.* But *Diemerbroeck* thinks that the ſtreight pyramidal and tranſverſe are all that ſerve for the compreſſion of the Belly, and that the oblique do elevate or dilate it. And he endeavours to prove this to be their action; *firſt*, becauſe there will be no Muſcles to elevate the parts of the *Abdomen*, if theſe do it not; whereas it is both evident to every one's own obſervation in himſelf, that the *Abdomen* is alternately elevated and depreſt, and alſo ſuch an alternate elevation and depreſſion ſeems neceſſary for the furthering the motion of the Aliments and Humours through the parts contained in the lower Belly. *Secondly*, he appeals to their oblique ſituation, which is inconvenient for preſſing. *Thirdly*, he thinks their riſe and the length of their Tendons evince, that their uſe is not to compreſs. For he ſays, when their fleſhy part grows tumid, they draw the Tendons with the *linea alba* outwards, and elevate them; and that this Intumeſcence ordinarily concurs with that of the Muſcles that dilate the Breaſt. *Caſp. Bartholin* believes the tranſverſe chiefly conſpire with the Diaphragm to reſpiration. For demonſtrating that the Diaphragm is a digaſtrick or double-bellied Muſcle, the nervous centre being the Tendon intervening between the two Bellies; he has obſerved further (in Oxen) that the forepart of the Diaphragm extends a particular Tendon to the end of each of the *coſtæ nothæ*, whereto the upper part of theſe tranſverſe Muſcles firmly alſo adheres; and ſo he ſuppoſes that there is a continuation of the one into the other,

the

the two bellies of the Diaphragm, and the tranſverſe Muſcle making on each ſide a trigaſtrick one. And upon this ſuppoſition he is of opinion, “ That ſeeing in inſpiration, wherein the Breaſt is to be dilated, the Ribs ought to be drawn upward, at which time alſo the fleſh of the ſaid trigaſtrick Muſcle is relaxed, and the Diaphragm, being from bowed become more plane and relaxed, and thruſt toward the *Abdomen*, permits the Ribs to be a little lift up and elonged for the dilatation of the Breaſt; which when at length it is contracted by the fleſhy Fibres of this trigaſtrick Muſcle, the Ribs return to their former Angles with the *Vertebræ*, and the contracted Fibres of the Diaphragm from plane becoming bowed, do aſcend up further into the cavity of the Breaſt, which, by depreſſing the *Sternum* alſo, they ſtraiten, and ſo cauſe the Air to be expelled out of the Lungs.] So that he makes the chief Uſe of the tranſverſe Muſcles to be to aſſiſt Expiration.

CHAP. XVIII.

Of the Muſcles of the Genitals, both in Men and Women.

IN the Firſt Book, *Chap.* 23. *Of the Yard*, we deſcribed its Muſcles and their Action, whither the Reader may pleaſe to turn, and here we ſhall but juſt name them. They are *two* Pair. The *firſt* are the *Erectores* or *Directores*, which ariſe from the inner knob of the *Coxendix*, and are inſerted

The Penis hath two Pair.

ſerted into the nervous bodies of the *Penis*, near their beginning. The *ſecond* are the *Acceleratores*, which ariſe from the *Sphincter* of the *Anus*, and paſſing on the under ſide of the *Penis* (by the ſides of the *Vrethra*) end about its middle.

The *Clitoris* in Women, (ſomething reſembling the *Penis* in Men) hath alſo *two* Pair of Muſcles, which having deſcribed *Book* I. *Chap.* 29. we ſhall not inſiſt on here, but remit the Reader thither.

The Clitoris *hath alſo two Pair.*

As to the *Cremaſter* Muſcles by which the *Teſtes* are ſuſpended in Men, ſee them deſcribed *Book* I. *Chap.* 31. As for Womens *Teſtes*, they have no Cremaſters.

CHAP. XIX.

Of the Muſcles of the Bladder and Anus.

THE *Bladder*, as was ſhewn in the Firſt Book Chap. 19. conſiſts of three Membranes, whereof the middle is muſcular, being endued with carnous Fibres; yea by *Spigelius* it is reckoned for a *Muſcle*, and called *Detruſor Urinæ*. But in the above-mentioned place we have deſcribed it under the notion of a *Membrane*; and what is there ſaid of it may ſuffice, unleſs we would enter upon a Controverſie of Names.

Excluding that Membrane therefore from the number of *Muſcles*, the Bladder will have but *one*, namely its *Sphincter*, which encompaſſes its Neck, (and environs the Proſtates alſo.) In Men it is about two inches broad, and is generally eſteemed to be nothing elſe but the middle

The Bladder hath but one Muſcle.

Mm 2

Membrane here grown more carnous than in the reſt of the Bladder. Its Fibres are orbicular, and by the contraction of them is the Neck of the Bladder conſtringed or purſed up, ſo that the Urine cannot paſs out unleſs they be voluntarily relaxed, or rather unleſs when they are overpower'd by the contraction and compreſſion of the Muſcular Membrane, *&c.* for then they are forced to give way to the Urine. In Women it is not ſo broad becauſe the Neck of their Bladder is ſhorter, but it reaches to the hole by which the Urine paſſeth into the *Vagina Uteri*, and ſeemeth to form it.

The Anus *three.*

The *Anus* hath *three* Muſcles. The *firſt* is the *Sphincter Ani.* This is fleſhy, and encompaſſes the end of the ſtreight Gut, being two inches broad. Its Fibres are orbicular. It doth not ſpring from any adjacent Bone, but onely adheres to the *Coccyx.* It ſerves to purſe up the Fundament, and ſo hinders the involuntary Evacuation of the *Fæces.* The *ſecond* and *third* are called *Levatores.* Theſe ſpring from the inſide of the Ligaments of the *Coxendix* and *Os ſacrum*, being broad and membranous, from whence paſſing by the ſides of the ſtreight Gut, they ſtick to it, and are inſerted into the upper part of the *Sphincter.* Theſe draw up the Fundament again after it is made to ſtrut out in ſtraining to ſtool; yea they prevent its falling out, which ſometimes happens upon their violation.

CHAP.

CHAP. XX.

Of the Muſcles of the Scapula *or Shoulder-blade.*

THUS we have done with the Muſcles of all the three *Venters:* now we come to thoſe of the *Limbs.* And firſt of the *Scapula* or *Shoulder-blade.*

Each Scapula *hath four Muſcles.*

1. It is moved forward, backward, upward and downward, and for the performance of theſe motions hath four *proper* Muſcles. The *firſt* is called *Trapezius*, as alſo *Cucullaris*, becauſe it with its fellow covering the Back reſembles a Monk's Cowl. It ariſeth fleſhy from the lower part of the *Occiput* towards the Ear; but from the poſterior Proceſſes or Spines of the five loweſt *Vertebræ* of the Neck, and of the eight uppermoſt of the *Thorax* it ſpringeth membranous. Being thus broad at its Riſe, it grows narrower in its Progreſs, and is inſerted into the whole Spine of the *Scapula*, into the Shoulder-point, and broader part of the *Clavicula.* Now through its large beginning and indifferent narrow Tendon or End, it comes to paſs that its fibres hold a various courſe; ſome of them being *ſtreight*, others *obliquely deſcending*, and others *obliquely aſcending.* Whence it is alſo that it performs divers Offices; for it draws the *ſcapula* directly backwards by its ſtreight Fibres, (which ſpring from about the firſt and ſecond *Vertebræ* of the *Thorax*;) obliquely downwards, by the obliquely aſcending, (which ariſe *below* the ſtreight:) and obliquely upwards, by the obliquely deſcending, (which ariſe *above* the ſtreight.)

2. The *ſecond* is *Levator*, or *patientiæ Muſculus*, ſo called from its helping to ſhrug up the Shoulders, when we would intimate that there is no Remedy but *Patience*. This hath its beginning from the tranſverſe Proceſſes of the firſt, ſecond, third and fourth *Vertebræ* of the Neck; which beginnings being united about the middle of the length of the Muſcle, it is at length inſerted by a broad and carnous Tendon into the upper corner of the Shoulder-blade, which it draws upward, and (as Authors ſay) ſomewhat forward.

3. The *third* is *Serratus minor anticus*. This lies under the Pectoral Muſcle, and ſprings from the four uppermoſt Ribs (except the firſt) before they become cartilaginous, by four fleſhy portions repreſenting the Teeth of a Saw, and is inſerted by a broad Tendon near to the Anchor-like Proceſs of the *Scapula*, which it draws forward towards the Breaſt.

4. The *fourth* from its Figure is called *Rhomboides*. This is placed immediately under the *Cucullaris*. It ſpringeth fleſhy from the hinder Proceſſes or Spines of the three loweſt *Vertebræ* of the Neck and ſo many uppermoſt of the *Thorax*, and is inſerted by as broad a fleſhy ending, as the beginning was, into the *Baſis* of the Shoulder-blade, which it draws backward.

Beſides theſe four *proper* Muſcles it hath others that are *common* to it with other Parts, which in ſome meaſure aſſiſt its Motions, as the *Serratus major*, deſcribed above, *Chap.* 15. and the *Deltoides*, which we ſhall deſcribe in the next *Chapter*.

CHAP.

CHAP. XXI.

Of the Muſcles of the Arm.

THE *Arm* in common acceptation is meant of all the diſtance betwixt the Shoulder-point or Neck of the Shoulder-blade, and the Wriſt; but we take it more ſtrictly here for that part onely that reaches from the Shoulder to the Elbow, (which it ſelf is otherwiſe called *humerus*) and conſiſts of one bone, which we ſhall call the *Shoulder-bone*. It hath five motions, for it is moved backward, forward, upward, downward, and circularly. *Each Arm hath nine Muſcles.*

Erectors. It is moved upward by two Erectors, *Deltoides* and *Supraſpinatus*. 1. *Firſt*, *Deltoides* (ſo called becauſe in ſhape it reſembleth the Greek Letter *Delta* Δ) ſpringeth nervous and broad from the middle of the *Clavicula*, the top of the Shoulder, and the whole Spine of the *Scapula*, as from ſo many diſtinct beginnings. But preſently becoming carnous and thick, it grows narrower and narrower in its Progreſs, till it end in a ſtrong Tendon (carnous without and nervous within) which is inſerted tranſverſely into the middle of the Shoulder-bone, and moves it either upward and forward towards the Face, or elſe backwards, as theſe or thoſe of its fibres are contracted. And beſides its moving of the *Humerus*, it helps alſo to draw up the *Scapula*.

2. The *ſecond* is *Supraſpinatus*, or *Superſcapularis ſuperior*. This ariſes from the *Baſis* of the *Scapula*, and fills up the upper *Interſcapulium*, *viz.* all that cavity that is betwixt its Spine and upper Edge;

and paſſing over the jointing of the *Scapula* with the Shoulder-bone, by a broad and ſtrong Tendon is inſerted obliquely into the neck of the latter. Some think this doth not only lift the Arm upward, but help to turn it about alſo.

Depreſſors. It is pulled down by *Latiſſimus*, and *Rotundus major*.

1. *Latiſſimus* is ſo called from its largeneſs; for with its fellow it covereth almoſt the whole Back. It is called alſo *Ani Scalptor*, or *Terſor*; becauſe thoſe Offices are performed by the help of this Muſcle. It ſprings by a broad membranous beginning from the hinder Proceſſes or Spines of all the *Vertebræ* of the Back-bone, that are betwixt the ſixth of the *Thorax*, and the middle of *Os ſacrum*, as alſo from the upper edge of *Os ileum*: then paſſing upwards when it is come to that part of the Back, where the Ribs begin to bend, it becometh fleſhy, and is carried over the lower corner of the *Scapula*, (from which alſo it often receives many carnous Fibres) where becoming narrower, it is inſerted into the Shoulder-bone, by a ſhort broad Tendon, between the *Muſculus pectoralis* and this that follows, *viz.*

2. *Rotundus major*, or more properly, *Teres major*. (For *Rotundus* means a thing ſphærical, but *Teres* long and round like a Thread, as this is.) It ſpringeth carnous from the whole lower edge of the *Scapula*, and is inſerted by a ſhort and ſtrong Tendon into the Shoulder-bone, a little below its Neck, and moves it contrary to the *Deltoides*, *viz.* downward and ſomewhat backward.

Movers forward. It is drawn forward by *Pectoralis* and *coracoideus*.

1. *Pectoralis* hath a very large and for the greateſt part membranous beginning, ariſing from divers parts, yet is one and continuous. In its *upper* part it riſes from the middle of the *Clavicula*; in its *middle*, from the whole length of the *Sternum* and the Cartilages of the Ribs annexed to it; in its *loweſt*, from the Cartilages of the ſixth, ſeventh and eighth Ribs. It preſently becomes carnous and thick, but narrower, and running towards the Shoulder it is inſerted into the Shoulder-bone, a little below its Head, between the *Deltoides* and the *Biceps* of the Cubit. The Fibres of this Muſcle are of three ſorts, *viz.* obliquely deſcending, ſtreight (or tranſverſe) and obliquely aſcending; and accordingly it draws the *Os humeri* either directly forward towards the Breaſt by its middle ſtreight Fibres, or elſe obliquely forwards, *viz.* forward and upward, or forward and downward, as the obliquely deſcending, or obliquely aſcending Fibres are contracted.

Coracoideus or *Coracobrachiæus* ſpringeth from the *Coracoides* Proceſs of the *Scapula*, and endeth about the middle of the Shoulder-bone, aſſiſting the obliquely deſcending Fibres of the *Pectoralis* in moving that Bone obliquely forward and upward. 2.

It is moved backward by *three: Infraſpinatus*, *Subſcapularis* or *Immerſus*, and *Rotundus minor*. *Pullers backward.*

1. *Infraſpinatus* or *Supraſcapularis inferior* ſpringeth from the lower *Baſis* of the *Scapula*, and filleth up the lower *Interſcapulium*, *viz.* all that ſpace that is betwixt its Spine and lower edge, as the *Supraſpinatus* did that between the Spine and upper edge. It is inſerted by a broad and ſhort Tendon into one of the Ligaments that ſtrengthen the jointing of the Shoulder-bone with the *Scapula*.

2. *Subſcapularis* or *Immerſus* poſſeſſeth the whole inner cavity of the *Scapula*. It ſpringeth from the inner part of its *Baſis*, fleſhy, and ſo continu-

ing, paſſeth forward (but becoming ſtill narrower) to the Neck of the *Scapula*, and at the laſt by a broad Tendon is inſerted into one of the Ligaments that ſtrengthen the aforeſaid Shoulder-joint.

3. *Rotundus minor* ariſeth from the loweſt corner of the *Scapula* by a fleſhy beginning, and is implanted into the Neck of the Shoulder-bone. Some make but one Muſcle of this and the *Rotundus major.*

As to the circular motion of the Arm, that is not performed by any particular Muſcle, but ſeveral of theſe contribute towards it, namely the *Supraſpinatus*, *Infraſpinatus* and *Subſcapularis*, and in ſome meaſure the others alſo.

CHAP. XXII.

Of the Muſcles of the Ulna.

THE lower part of the Arm from the Elbow to the Wriſt is called the Cubit, and conſiſteth of two Bones, called *Ulna* and *Radius*. The *Ulna* ſerveth for flexion and extenſion; but the *Radius* helpeth to turn the Cubit inward or outward, ſo as to make the back or palm of the Hand look upward or downward.

Two Benders of the Ulna. The *Ulna* is bended by *two*, to wit, *Biceps*, and *Brachiæus internus*. *Biceps* is ſo called becauſe it hath *two heads*, both of which ſpring from the Shoulder-blade. 1. The one is outward, tendinous and round, ſpringing from the upper brim of the *Acetabulum*, or cavity of the *Scapula*, into which the head of the Shoulder-bone is received; The other is broader, and is framed partly of a Tendon, and partly of Fleſh: it ſprings from the Anchor-like Proceſs of the Shoulder-blade, from whence deſcending by the inſide of the head of the Shoulder-bone, it meeteth with the former, and both together become a ſtrong fleſhy Muſcle: which lying on the inſide of the Arm, afterwards ends in a thick, round, and ſtrong Tendon, which is inſerted into the inſide of the head of the *Ulna*, (or of the *Radius*, as *Bartholin* will have it.) This Tendon is ſometimes pricked in letting blood in the Arm, and then it cauſeth great Pain.

2. *Brachiæus internus* lieth under the *Biceps*, being ſhorter than it, and altogether fleſhy. It riſeth where the *Deltoides* endeth, *viz.* from the middle of the Shoulder-bone, unto which it cleaveth firmly, and is inſerted between the heads of the *Ulna* and *Radius*, in their foreſide.

Four Extenders.

The *Ulna* is extended by *four* Muſcles, *Longus*, *Brevis*, *Brachiæus externus*, and *Cubitalis*.

1. *Longus* hath two beginnings; the one is partly fleſhy and partly nervous, at the lower edge of the *Scapula*, near its Neck, (where it hath a peculiar hollowneſs to receive it:) this deſcends by the inſide of the Shoulder-bone, and when it is come as far as the inſertion of the *ani ſcalptor* (deſcribed in the foregoing Chapter) there ariſes another carnous beginning towards the outer ſide, that (according to *Spigelius*) joins with it and makes up one Muſcle, which is inſerted into the inner ſide of the hinder Proceſs of the *Ulna* called *Olecranum*.

2. *Brevis* ariſeth from the hinder part of the Neck of the Shoulder-bone, and endeth in the outer ſide of the *Olecranum*; namely, in that part of the Elbow that we lean upon.

Brachiæus externus (ſo called by *Riolanus* to diſtinguiſh it from the *internus*) is placed towards the outſide of the Shoulder-bone, and is confounded with the other two, and endeth where they do. This ſeemeth to be *Spigelius*'s ſecond beginning of the *Longus*, which he ſays grows into one Muſcle with it.

4. *Cubitalis* or *Anconæus* ariſeth from the lower end and hinder ſide of the Shoulder-bone, and paſſing over the Elbow-joint, it endeth by a nervous Tendon in the ſide of the *Ulna*, a very little below the *Olecranum* or *Ancon*, whence it is called *Anconæus*. Some make one Muſcle of this and the *Brevis*.

Note, That the Fibres of both theſe Benders and Extenders of the *Ulna* keep all a ſtreight courſe, and ſo onely move the Cubit ſtreightwiſe.

CHAP. XXIII.

Of the Muſcles of the Radius.

The Radius *hath four Muſcles.*

THE *Radius*, the other Bone of the Cubit, is moved *accidentally* (or in *common*) by the Muſcles of the *Ulna*, to which Bone it is faſten'd; but it has beſides, *proper* motions of its own, and for the performance of theſe, two ſorts of Muſcles; of which ſome are called *Pronatores*, *viz.* thoſe that turn it inwards, and the Palm of the Hand upwards; and others *Supinatores*, which turn it outwards, and the Palm of the Hand downwards.

The *Pronatores* are *two* in number. The *firſt* is, *Pronator ſuperior rotundus* or *teres*. This ſpringeth from the root of the inner knob of the Shoulder-bone at the Elbow, and from the inner ſide of the *Ulna*, where it is joined to the Shoulder-bone; and running obliquely on the inſide of the *Radius* endeth about its middle in a membranous Tendon. *Two* Pronatores. 1.

2. The *ſecond* is *Pronator inferior quadratus*, which is altogether fleſhy. It ſpringeth from the lower and inner part of the *Ulna* two Inches broad; then marching tranſverſly above the Ligament which joineth the *Radius* to the *Ulna*, it endeth in the inſide of the *Radius*. The ending is as broad as the beginning; wherefore it is called *quadratus* or four-ſquare.

The *Supinatores* are in like manner *two*. The *firſt* is *Supinator longus*, ſo called, becauſe, of all the Muſcles which lie along the *Ulna*, it hath the longeſt Belly. This ſpringeth fleſhy from the edge of the outer knob of the Shoulder-bone; and marching obliquely under the *Radius*, is implanted by a membranous Tendon into the upper ſide of the lower end of the *Radius*, bending ſomewhat to the inner ſide. *Two* Supinatores. 1.

2. The *ſecond* is *Supinator brevis*. This ſpringeth from the outſide of the ligament which ſtrengthens the jointing of the *Ulna* with the Shoulder-bone, and from the hinder Proceſs of the *Ulna*, as *Spigelius* deſcribes it; but as others, from the outer Proceſs of the Shoulder-bone; from whence it paſſeth on obliquely, being without membranous, and within fleſhy, and is inſerted into the middle of the *Radius*.

Note, That though for orders ſake we have deſcribed the Muſcles of the *Radius* next to thoſe of the *Vlna*; yet when one would ſhew them in diſſection, the Muſcles of the Fingers, Thumb and Wriſt are firſt to be raiſed, and then theſe of the *Radius* after thoſe are taken away.

CHAP. XXIV.

Of the Muſcles of the Wriſt.

The Wriſt hath four Muſcles. THE *Carpus* or *Wriſt* has three Motions: It is either bended, extended, or moved ſideways. For its flexion and extenſion it has proper Muſcles: but as for its motion ſideways, that is not performed by any proper Muſcles, but by a Bender and an Extender of that ſide to which it is moved, if they act together. The Benders lie on the inſide of the Cubit, and the Extenders on the outſide.

Two Benders. The *Benders* of the Wriſt are *two*; of which the *firſt* is *Cubitæus internus*: this ariſeth by both 1. a fleſhy and nervous beginning from the inner tubercle or knob of the Shoulder-bone; then paſſing fleſhy the length of the *Vlna* or *Cubitus*, (to which it immediately adheres) it ends by a Tendon, partly nervous, and partly fleſhy, in the fifth bone (ſome ſay the fourth of the firſt rank) of the Wriſt.

2. The *ſecond* is *Radiæus internus:* this ariſing from the ſame tubercle, paſſes along the *Radius* (adhering to it;) and before it comes to its lower end, turns into a round Tendon, which proceeding forward grows to the tranſverſe Ligament of

the Wriſt; but ſtill paſſing further and waxing broader, it is at laſt inſerted into that Bone of the back of the Hand which is ſet before or ſuſtains the fore-Finger.

The *Extenders* are alſo *two*. *Two Extenders.*

1. The *firſt* is *Radiæus externus*, or *bicornis:* this ariſeth by a double Origine from that bony tip of the Shoulder-bone, and from the outer knob of the ſame: then becoming more fleſhy, it paſſeth along the *Radius* to its middle, where it turneth into a ſtrong Tendon, which preſently is divided into two almoſt round Tendons. Both theſe paſs a little aſunder by the *Radius* under the Ligament of the Wriſt, and are one of them inſerted into that Bone of the back of the Hand which ſtayeth the fore-Finger, and the other into the Bone which ſtayeth the middle Finger.

2. The *ſecond* is *Cubitæus externus:* this hath its beginning from the root of the external knob of the Shoulder-bone: it paſſeth along the *Cubitus* or *Ulna*, and when it is come to the Wriſt, it endeth in a ſtrong round Tendon, which is inſerted into the upper part of that Bone, which ſtayeth the little Finger, not far from the Wriſt.

CHAP. XXV.

Of the Muſcles of the Palm of the Hand.

The Palm hath two Muſcles.

THE *Palm* of the Hand is ſaid to have *two* Muſcles. 1. The *firſt* is *Palmaris*, which ariſeth from the inner knob of the Shoulder-bone, round and nervous, but preſently becoming fleſhy it continues its courſe along the *Ulna*, under all the other Muſcles, but about the middle of the ſaid Bone it turns into a round Tendon, which paſſing over the tranſverſe or annular ligament of the Wriſt, is afterwards dilated into a broad nervous membrane, which cleaveth firmly to the skin of the Palm of the Hand, (cauſing it to be of moſt exquiſite ſenſe) and endeth in the inſide of the firſt joint of the Fingers. This Muſcle ſpreading its Tendon thus in the Palm, beſides that it adds much to its ſenſibleneſs, helps to contract and wrinkle the skin thereof, for the taking the faſter hold in graſping of a thing.

2. The *ſecond* is *caro quædam quadrata*, or a four-ſquare fleſhy ſubſtance: this ſpringeth from the *Membrana carnoſa* that covereth that region where the eighth bone of the Wriſt is placed. From thence it is carried under the dilated Tendon of the *Muſculus palmaris*, to the middle of the Palm of the Hand, and there ends. *Spigelius* ſays, it is inſerted into the outſide of the Tendon of that Muſcle which moveth the little Finger outwards. It looks as if it conſiſted of two or three Muſcles, and ſerveth (as ſome think) for the hollowing of the Palm of the Hand, by drawing the outſide of it towards the Ball of the Thumb; but, according to *Spigelius*'s Opinion, it ſerves rather to withdraw it, and ſo to ſpread the Palm open.

CHAP.

CHAP. XXVI.

Of the Muſcles of the four Fingers.

THE *Fingers* are bended, extended, and moved laterally. By *the Fingers* we mean only the four, excluding the Thumb, whoſe motion differs very much from that of the other; and therefore we ſhall deſcribe its Muſcles in the next Chapter, as being altogether diſtinct from theſe.

Three benders of the Fingers.

The Fingers are bended by *three* Muſcles, (or rather by ſix.) The *firſt* is called *Sublimis*, or *perforatus*. This ſpringeth ſomewhat nervous, from the inner knob of the Shoulder-bone, and deſcends fleſhy betwixt the *Ulna* and *Radius* till near the Wriſt, where it is cleft into four fleſhy portions, which preſently paſs into ſo many round Tendons, all whereof are involved together in one common, thin, and mucous Membrane, that they may march the more ſafely. Thus they are carried under the tranſverſe Ligament of the Wriſt, and along the Palm to the ſecond joynt of the Fingers (growing there broader and thinner) into which they are inſerted, one into each. *Spigelius* notes, That as they paſs along the firſt Joynt, they run under a tranſverſe Ligament (that ſprings from one ſide of the bone and is inſerted into the other) as under an arch: which Ligament hinders them upon their contraction from ſtarting up out of their places. Near their end each has a Fiſſure or perforation, to give way to the Tendons of the *profundus* paſſing through. 1.

2. The *ſecond* is named *profundus* or *perforans.* This ariſeth from the upper parts of the *Ulna* and *Radius*, a little below the joint of the Elbow, and being cleft at the Wriſt into four Tendons, theſe run (inveſted in a common Membrane) under the annular ligament of the Wriſt, and alſo the tranſverſe ones of the firſt joint of the Fingers, and laſtly through the clefts of the Tendons of the *Sublimis*, and are implanted into the third joint of the Fingers.

3. The *third* ſort of Muſcles are called *Lumbricales*, one to each Finger. Theſe are very ſmall, and ariſing from the Tendons of the *Muſculus profundus*, end each in a round Tendon in the firſt joint of the Fingers, being confounded with the Tendons of thoſe Muſcles that move the Fingers laterally; yea ſometimes they proceed further along with them by the ſides of the Fingers, to the third joint, and aſſiſt their lateral motion. The firſt of theſe Muſcles bends the ſecond joint of the Fingers, the ſecond the third, and the *Lumbricales* the firſt.

Three Extenders. The Fingers are extended by *three* Muſcles, whereof one is *common* to all the four Fingers, and two *proper* to two particular.

One common. The *common* is *Extenſor magnus.* This ariſing from the outer knob of the Shoulder-bone, a little above the Wriſt is divided into four Tendons, which paſſing the Wriſt like the foregoing are inſerted into the ſecond and third joints of the Fingers. Some make two of this, ſuppoſing that Tendon that is inſerted into the little Finger, to be the Tendon of a Muſcle that is diſtinct from that from which the Tendons are propagated to the other three Fingers, but grant it has the ſame Origine and keeps the ſame courſe.

The

Two proper. 1.

The two *proper* are one of them called *Indicator*, becauſe it belongeth to the fore-Finger. It ariſeth from the middle of the *Ulna* on its outſide, and by a double Tendon it endeth in the ſecond joint of the fore-Finger: but one of the Tendons becometh one with the Tendon of the *Extenſor magnus.*

2.

The other is named *Auricularis*, becauſe it belongeth to the little Finger. It ariſeth from the upper part of the *Radius*, and marching between the *Ulna* and the *Radius* it is inſerted by a double Tendon into the backſide of the little Finger, of which Tendons one coaleſces with that of the common Extender.

Movers laterally, eight.

The Fingers are moved laterally two manner of ways: for either they are brought to the Thumb, or they are carried from it. Theſe Motions are performed by *eight* Muſcles, called *Interoſſei*, becauſe they are placed between the Bones of the *Metacarpium.* That is, ſix of them are placed in the three Interſtices of the four Bones of the *Metacarpium*, one on the outſide of that Bone which ſuſtains the fore-Finger, and another on the outſide of that which ſuſtains the little Finger. They are fleſhy and round, and ſpring from the Bones of the *Metacarpium*, to which they alſo adhere, as they paſs along them. When they are come to the Roots of the Fingers, they paſs into Tendons, which cleave to the ſides of the Fingers, and end in the laſt joint of the Fingers near the root of the Nails. When the Tendons of the *Lumbricales* join with theſe, they may be reckon'd amongſt the Movers of the Fingers laterally, and then there will be twelve in all, the *Lumbricales* being four, and theſe *Interoſſei* eight; but uſually the *Lumbricales* ſerve onely to bend the firſt Joint of the Fingers, as was ſhewed above.

Abducing Muſcles, two.

1. Beſides theſe Muſcles, the fore-Finger and the little Finger are ſaid to have each one *proper* Muſcle. That of the fore-Finger may either be called *Abducens* in reſpect of the middle Finger from which it draws it; or *Adducens*, in reſpect of the Thumb towards which it draws it. It ſprings from the inſide of the firſt Joint of the Thumb, and ends in the Bones of the fore-Finger, which it pulls towards the Thumb.

2. That of the little Finger is called *Abductor* (by ſome *hypothenar*) and ſprings from the third and fourth bone (of the ſecond rank) of the Wriſt; whence proceeding along the palm of the hand, it is implanted by a ſmall nervous Tendon into the outſide of the firſt Joynt of the little Finger, which it draws outwards from the reſt.

CHAP. XXVII.

Of the Muſcles of the Thumb.

Two Extenders of the Thumb.

1. THE *Thumb* is extended by *two* Muſcles. The *firſt* is called *Longior*. This ariſeth fleſhy from the outſide of the *Ulna*, near the membranous Ligament which tieth together the *Ulna* and *Radius*. From thence it is carried obliquely upon the *Radius*, and before it come to its *Appendix*, turneth into a round Tendon; which paſſing under the annular Ligament of the Wriſt, marcheth along that ſide of the Thumb, which is next to the fore-Finger, and is inſerted into its third bone.

The *ſecond* is named *Brevior*. This ariſeth from the ſame Origine with the other, and paſſeth obliquely above the *Radius*. By *one* Tendon it is implanted into the root of the firſt Joynt of the Thumb, (which anſwers to the bones of the *Metacarpium* that ſuſtain the Fingers;) the *other* becoming membranous, cleaveth faſt to its ſecond and third bone. 2.

Two Benders. It is bended alſo by *two* Muſcles; *one* of which ſpringing from the upper part of the *Radius*, is implanted into the firſt and ſecond Joynt of the Thumb; 1. the *other* being leſs, proceeds from that bone of the *Carpus* which ſuſtains the Thumb, lying under the other, and reacheth to the middle of the Thumb. 2. Theſe two are all the Benders acknowledged by *Bartholin*, *Diemerbroeck*, &c. but *Spigelius*, *de hum. corp. fabric.* l. 4. c. 19. deſcribes two which bend the firſt Joynt, four the ſecond, and one the third. Thoſe two which bend the firſt Joynt, together with the *Abducens* of the ſame, he ſays, make the *monticulus pollicis* or ball of the Thumb, or as Chiromancers call it *monticulus Lunæ*. Monticulus lunæ.

Movers laterally, two. It is moved laterally by *two* Muſcles. The *firſt* is called *Thenar* (by *Riolanus*) or *Abducens*. 1. This ſpringeth from the inner part of that bone of the Wriſt, which ſtayeth the Thumb, by a nervous beginning: then becoming fleſhy, it is inſerted into the firſt Joynt of the Thumb by a membranous Tendon, and draweth it from the fore-Finger. Some make three of it.

The *ſecond* is *Antithenar*, or *Adducens*, which lieth in the ſpace between the Thumb and fore-Finger. 2. This doth ariſe from the outſide of that bone of the *Metacarpium* which ſuſtaineth the fore-Finger; and being fleſhy is inſerted into the whole inner ſide of the firſt joint of the Thumb, and ſendeth a membranous Tendon to the ſecond. This draweth the Thumb to the fore-Finger, Some deſcribe a ſecond *Adducens* ariſing from the inner ſide of the bone of the Wriſt that ſuſtaineth the Thumb, and ending in its ſecond joint.

Authors differ very much as to the Number, Riſe, and Inſertion of theſe Muſcles of the Thumb, which is occaſioned partly by their ſmalneſs, and partly from their croſſing and being entangled one with another, ſo that 'tis very difficult to trace and raiſe them.

CHAP. XXVIII.

Of the Muſcles of the Thigh.

THE *Thigh* hath four manner of motions: it is either bended (and that forwards, or backwards) or drawn inward or outward, or moved round.

Two Benders forward of the Thigh. 1.

It is bended forward by *two* Muſcles. The *firſt* is called *Pſoas*, or *Lumbaris*: this lieth in the inner part of the *Abdomen*, upon the *Vertebræ* of the Loins, *&c.* It ariſeth fleſhy from the ſide of the Bodies and from the tranſverſe Proceſſes of the two lowermoſt *Vertebræ* of the *Thorax*, and two or three uppermoſt of the Loins, from whence deſcending by the inſide of *Os ilium*, when it is come to the *Os pubis*, it turns into a round and ſtrong Tendon, which is inſerted into the leſſer *Rotator* of the Thigh-bone.

The

2. The *ſecond* is *Iliacus internus:* This ſpringeth with a ſlender and fleſhy beginning from the inner Cavity of *Os ilium*, and being joined to the *Pſoas* by its Tendon, it endeth before between the greater and leſſer *Rotator.*

Three Benders backward.

It is bended backward or extended by the
three *Glutæi*, which make up the Buttocks, and
ſerve to go backward withall, or elſe to raiſe the
Body up ſtreight after ſitting. The *firſt* which 1.
is the greateſt, and lieth outmoſt, is called *Glutæus major.* It ſpringeth very carnous from the *Coccyx*, from the ſpine of *Os ſacrum*, and from all the circumference of the *Coſta* or edge of *Os ilium*, and is inſerted by a ſtrong Tendon four inches below the great *Rotator.*

2. The *ſecond* lies in the middle, whence it is called *Glutæus medius.* It ſpringeth from the forepart of the *Coſta* and back of *Os ilium* a little lower than the former, and is inſerted into the outer and upper part of the great *Rotator.*

3. The *third* lies undermoſt, and is called *Glutæus minor.* It ſpringeth a little lower than the former, (from the outer or backſide of *Os ilium*) lying wholly under it, and is implanted into the upper and inner part of the great *Rotator* by a broad and ſtrong Tendon.

One Drawer to the inſide.

It is drawn to the inſide by the *Muſculus triceps.* This is the thickeſt of all the Muſcles of the Body, and might more juſtly be called *quadriceps*, ſeeing it has four beginnings; but they that impoſed the name of *triceps*, made a particular Muſcle of the firſt of its four Heads, and called it *Pectineus* or *lividus.* The *firſt* Head doth proceed nervous from the upper part of the *Os pubis*, and is inſerted into the rough line of the Thigh-bone. The *ſecond* ſpringing from the lower ſide of the ſame bone, being leſſer is inſerted a little higher up into the ſaid line. The *third* ariſing from the whole lower part of the *Coxendix*, is inſerted a little under the leſſer *Rotator*. The *fourth* ſpringing from the *Apex* or tip of the *Coxendix* is implanted into the inner and lower Tubercle of the Thigh by a round Tendon, which is joyned with the ſlender Tendon of the firſt part of this Muſcle.

Four turners towards the outſide.

It is turned towards the outſide by *four* ſmall
Muſcles called *Quadrigemini*. They are placed
behind upon the articulation of the Thigh, one
1. by another. The *firſt* is called from its ſituation
Iliacus externus, and from its figure *pyriformis*;
it is longer than the reſt, and ariſeth from the
outſide of the three loweſt *vertebræ* of *os ſacrum.*
2. The *ſecond* ariſeth from the knob of *os iſchium.*
3. The *third* ariſeth from the ſame part. Theſe
three are inſerted into that dent that is in the
top of the great *Rotator*; or as *Bartholin* ſays, into that ſpace that is betwixt the two *Rotators*. The
4. *fourth* is called *Quadrigeminus quadratus*, and is
more fleſhy and broad than the reſt: it lieth two
inches diſtant from the third, ariſing from the inſide of the knob of the *iſchium*, and is implanted
into the outſide of the great *Rotator*.

Two turners about obliquely.

It is turned about obliquely by *two* Muſcles called *Obturatores*. The *firſt* is *Obturator internus*, this
turneth it outward. It ariſeth from the inner
1. circumference of the hole that is between the *iſchium* and *os pubis*, from whence paſſing tranſverſly outwards over the *Coxendix*, it is inſerted into
the aforeſaid dent or cavity of the great *Rotator*.

2. The *ſecond* is *Obturator externus*: this ariſeth from the outer circumference of the ſaid hole, and turning about the neck of the Thigh-bone as

about a Pulley, it endeth in the ſaid Cavity of the great *Rotator*, and turneth the Thigh inward.

Note, That though for orders ſake we have deſcrib'd the Muſcles of the Thigh before thoſe of the Leg, yet the Diſſector cannot ſo eaſily nor conveniently raiſe and ſhew them, till thoſe of the Leg are firſt raiſed and removed.

CHAP. XXIX.

Of the Muſcles of the Leg.

Five Benders of the Leg.

THE *Leg* is made up of two Bones as well as the Cubit, *viz. Tibia* and *Fibula*; but Anatomiſts have not diſtinguiſh'd their Muſcles like thoſe of the *Ulna* and *Radius*, but call them all, *the Muſcles of the* Tibia *or Leg.*

Now the *Leg* is either bended, extended, or moved obliquely.

1. There are *five* that bend it. The *firſt* is *Longiſſimus.* This ariſeth from the inner knob of *Os Ilium*, and deſcends outermoſt juſt under the skin on the inſide of the Thigh, running obliquely over the other Muſcles, and a little above the Knee ending in a Tendon, which is inſerted under the Knee, into the fore and inner ſide of the *Tibia.* It is otherwiſe called *Faſcialis*, becauſe it embraces the Muſcles that lie upon the Thigh like a *Swaddling-band*; and alſo *Sartorius*, becauſe it helpeth one to ſit croſs-legg'd.

2. The *ſecond* is called *Gracilis*, and ſpringeth with a nervous and broad beginning at the jointing

ing of the *Os pubis*; from whence it runs down the inſide of the Thigh, and is implanted by a round Tendon into the inner ſide of the *Tibia*, near the Inſertion of the firſt, but a little lower.

3. The *third* is named *ſeminervoſus*, becauſe it is *half nervous* and half fleſhy; for it ariſes nervous from the knob of the *Iſchium*, and ſo continues till its middle where it becomes fleſhy, deſcending on the backſide of the Thigh; and when it is come near the Ham, it turns into a round Tendon, which is inſerted into the inner ſide of the *Tibia*, towards the backſide, running as far as its middle.

4. The *fourth* is called *ſemimembranoſus*, becauſe it is *half membranous*. It proceedeth from the ſame knob, partly nervous, and partly membranous; and endeth by a broader Tendon than the third in the hinder part of the *Tibia*.

5. The *fifth* is called *biceps*, becauſe it ſeems to have *two Heads*: for firſt it ariſeth from the ſame knob of the *Iſchium* nervous; and from thence being carried on the outſide of the Thigh, about its middle it becometh fleſhy, as if it begun there with a ſecond head; from whence deſcending it is inſerted by a notable Tendon into the outer ſide of the upper Appendix of the *Fibula*.

Five Extenders. The Leg is extended alſo by *five* Muſcles. The 1. *firſt* is *membranoſus*: this proceeding fleſhy from the upper part of the ſpine of *Os ilium*, on the outſide of the Thigh-bone near the great Proceſs or *Rotator* turns into a broad membranous Tendon, wherefore it is called *Faſcia lata*, for it covereth almoſt all the Muſcles of the Thigh and *Tibia*, and at laſt is inſerted a little below the

Knee, into the outer and foreſide of the *Tibia* and *Fibula.*

2. The *ſecond* is *Rectus:* this ſpringing from the lower part of the ſpine of *Os ilium*, and paſſing with a carnous and round belly ſtreight down the Thigh before, when it is come to the *Patella*, it ends in a broad and ſtrong Tendon, by which it adheres cloſe to the *Patella*, as if it would end in it; but it paſſes further and is inſerted into the foreſide of the *Tibia* a little below the Knee.

3. The *third* is named *vaſtus externus:* this ſpringeth from the root of the greater *Rotator*, and deſcending along the outer and foreſide of the Thigh endeth a little below the *Patella*, near the ſame place with the former.

4. The *fourth* is called *vaſtus internus:* this ariſeth from the root of the leſſer *Rotator*, and deſcending on the inner and foreſide of the Thigh endeth a little below the *Patella* with the other. The *Vaſtus externus* deſcends on the *outſide* of the *rectus*, and the *internus* on the *inſide* thereof, whence they have their name.

5. To theſe ſome add a *fifth* Muſcle called *Cureus*, which ſpringeth from the fore-part of the Thigh-bone, between the two *Rotators*, and adhering cloſe thereto in its deſcent, endeth in the ſame place with the former.

Note, That theſe four laſt Muſcles being joined together about the Knee, make one common broad and ſtrong Tendon, by which they involve the *Patella* or Knee-pan, and which being inſerted into the *Tibia*, tyes it and the Thigh-bone together like a ſtrong Ligament. *Note* alſo, That the Muſcles which extend the Leg are ſtronger than thoſe which bend it, that the weight of the

Body may be the more firmly upholden when we ſtand.

One Mover obliquely. There is alſo a ſingle Muſcle called *Poplitæus*, or *Subpoplitæus*, which moveth the Leg obliquely: this lieth in the hollow of the Ham, and ſpringeth from the outer knob at the lower end of the Thigh-bone, and is carried obliquely to the hinder and inner ſide of the Appendix at the upper end of the *Tibia*.

CHAP. XXX.

Of the Muſcles of the Foot or Tarſus.

THE *Foot* is moved according to the motion of the *Tarſus* or *Wriſt*, (or as ſome call it the *Inſtep*, though that name is more proper to the *Metatarſus* or upper arched part of the Foot.) Wherefore the Muſcles that perform theſe motions, are indifferently called the Muſcles of the Foot or *Tarſus*.

Two Benders of the Foot. The Foot then is either bended, extended, or moved ſideways, according to the motion of the *Tarſus*. It is bended when it is drawn forwards or upwards. To perform which motion it hath *two* Muſcles. The *firſt* is *Tibiæus anticus:* this 1. ariſeth from the upper Appendices of the *Tibia* and *Fibula*, and cleaving unto the whole *Os Tibiæ*, about the middle of it it becometh narrower, and turneth by degrees into a Tendon, which paſſing under the annular ligament of the *Tarſus* or Wriſt that ſprings from the lower Appendices of the *Tibia* and *Fibula*, is commonly divided into two; whereof the one is inſerted into the firſt of thoſe bones which are called *innominata*, and the other into that bone of the *Metatarſus* or Inſtep that is ſet before the great Toe. If the Tendon continue one, then it is implanted into the inner ſide of this laſt Bone.

2. The *ſecond* is *Peronæus anticus:* this ariſeth from the outer and upper part of the *Perone* or *Fibula*, and being carried through the fiſſure of the outer Ankle, it is inſerted into that Bone of the *Metatarſus* which ſuſtaineth the little Toe. It deſcends all along by the outſide of the foregoing Muſcle, and hath ſometimes two Tendons.

Three Extenders. The Foot is extended when it is drawn downwards or backwards. To perform which motion it hath *three* Muſcles. 1. The *firſt* is called *Gemellus externus*, being reckoned by ſome for *two*; alſo *Gaſtrocnemius externus*, becauſe it with the following maketh *the Calf of the Leg*, which in Greek is called *Gaſtrocnemia.* It hath two Heads, the firſt of which ariſes in the Ham, from the inner Head of the Thigh-bone, fleſhy and broad; from whence it marcheth down by the back and inner part of the *Tibia*, and when it is come to the middle of it, becometh tendinous. The other Head likewiſe ariſeth in the Ham, but from the outer Head or Prominence of the Thigh-bone, and paſſing down by the outward and back part of the Leg, becometh tendinous a little above the former, and joining with it they both grow into one ſtrong, broad, and nervous Tendon, which is inſerted into the hinder ſide of the Heel.

2. The *ſecond* is called *Gemellus internus*, or *Gaſtrocnemius internus*, becauſe it lieth under the former; and laſtly *Soleus*, from its reſembling the

Sole-fiſh in ſhape. It is of a livid colour, ſpringing from the backſide of the upper *Appendix* of the *Fibula* by a ſtrong nervous beginning, and growing pretty bulky it continueth ſo till it hath paſſed the middle of the *Tibia*, when it becometh narrower, and tendinous; and a little above the Heel it is ſo united to the Tendon of the former *Gemellus*, that both ſeem to turn into one, which is inſerted into the Heel.

3. The *third* is *Plantaris.* This ſpringeth from the outer head of the Thigh-bone in the Ham, very ſmall but carnous; from whence it deſcends but a little way before it ends in a very long and ſlender Tendon, which joining very cloſely with thoſe of the two former is faſtened to the Heel, but reaches as far as the middle of the ſoal of the Foot: (*Spigelius* ſays, as far as the Toes, and is inſerted into the firſt joint of each of them, imitating the *Palmaris* of the hand.) The three Tendons of theſe three Muſcles thus uniting make one moſt ſtrong and thick Tendon, uſually called *the great Cord*; and this being implanted into the Heel makes a wound there ſo very dangerous.

Two Movers ſideways.

1. The Foot is moved ſideways by *two.* The *firſt* is called *Tibialis poſticus*, *adducens pedem*, or *Nauticus*, becauſe Sailers uſe it much when they climb up the Maſt. It ſpringeth both from the *Tibia* and *Fibula*, and from the Ligament which tyeth them together; whence deſcending among the hinder Muſcles, near to the inner Ankle it becometh tendinous: then paſſing by it, it goeth to the ſoal of the Foot, and is inſerted into the under ſide of that Bone of the *Tarſus* which is next to the *cubiforme*, *viz.* the third *cuneiforme.* This moveth the Foot inwards.

The *ſecond* is called *Peronæus* or *Fibulæus poſticus:* this ariſeth from the upper and hinder part of the *Fibula* or *Perone*, by a nervous and ſtrong beginning; and in its deſcent becoming fleſhy and round, it cleaves to the outſide of the *Fibula*, having its outer part of a livid colour, but the inner of a red. When it is come to the middle of the *Fibula* it becometh tendinous, and deſcends with the *Peronæus anticus* by the fiſſure of the outer Ankle, but joins not with its Tendons, for it goes under the ſoal of the Foot, and is inſerted into the root of the firſt or greateſt of the three *Oſſa cuneiformia*, that is ſeated before the great Toe. 2.

Sometimes, though ſeldom, there is another Muſcle, called *Peronæus tertius*, which being very ſlender accompanies the *poſticus* in its whole progreſs, and is inſerted into the ſame place, aſſiſting its Action, which is, to bend the Foot outwards.

CHAP. XXXI.

Of the Muſcles of the Toes.

THE great *Toe* is moved by its *proper* Muſcles, as the Thumb of the Hand was: but the other four by *common*, which we will firſt deſcribe.

They are either extended, bended, or moved obliquely.

Two Extenders of the four Toes.

1. The Extenders are *two*. The *firſt* is *Tenſor longus*. This ariſeth by a nervous and acute beginning from the fore and inſide of the upper *Appendix* of the *Tibia*, and preſently becoming carnous, it goeth ſtreight down along the *Fibula*, and being come to the *Tarſus* it is divided into four Tendons, which paſſing under the annular or tranſverſe Ligament thereof, go each to one of the four leſſer Toes, and are inſerted into their ſecond and third joint on the upper ſide. As they run along the backſide of the Foot they are tyed one to another by a membranous Ligament, for the ſtrengthening of them.

2. The *ſecond* is *Tenſor brevis.* This lieth under the former, having its beginning from the tranſverſe or annular Ligament of the *Tarſus*, fleſhy and broad, and by its four Tendons is inſerted into the firſt joints of the four Toes; (*Spigelius* ſays, into the ſecond.)

Six Benders. The *Benders* of the four Toes are in like manner *two*, and *four Lumbricales.* The *firſt* is *Flexor*

1. *longus*, or *perforans:* it lieth under the *Gemellus internus*, and ariſeth from the upper and hinder part of the *Tibia* by a long and fleſhy beginning; and paſſing down along the *Tibia*, (unto which it cleaveth) when it is paſt the middle of it, it becometh tendinous: then running by the inner Ankle, under the Ligament of the *Tibia* and Heel, to the Soal of the Foot, it is there divided into four Tendons, which paſſing through the holes of the *Flexor brevis*, are inſerted into the third or laſt joint of the four Toes.

2. The *ſecond* is *Flexor brevis*, or *perforatus:* this ſpringeth from the under and inner ſide of the Heel-bone, and when it hath paſſed the middle of the Foot, it is parted into four round Tendons, which are inſerted into the ſecond joint of the four Toes, being perforated to give way to the Tendons of the former Muſcle to paſs to the third joint.

They

Lumbricales.

They are alſo bended by *four Lumbricales*, which agree altogether with the *Lumbricales* of the hand both in their uſe, Figure and Riſe. Theſe ſpring from the Tendons of the two former, ſmall and round, (or rather from the membranous Ligament that incloſes them) and are inſerted by a ſmall Tendon into the ſide of the firſt joint, which they help to bend. The fleſhy ſubſtance, which riſeth with two acute beginnings from the fore part of the lower ſide of the Heel-bone, and reacheth to the Riſe of theſe Muſcles, ſeemeth much to further their Action, and to afford them their carnous Subſtance.

Ten Movers obliquely.

The Toes are moved obliquely by the *Interoſſei*, which are ſo called, becauſe they are placed *between the bones* of the *Metatarſus*. They are *ten* in number, whereas there are but eight in the back of the Hand, becauſe the *Metatarſus* hath one bone more than the *Metacarpus*, there being one to ſuſtain the great Toe as well as the reſt, whereas the Thumb hath none. Each of them doth ſpring from the under ſide of that bone upon which it is placed, but preſently turning to its ſide, it keeps its courſe along the interſtice of the bones till it arrive at the firſt joint of the Toe, into the ſide whereof it is inſerted by a ſhort and ſomewhat broad Tendon. If the inner be contracted, the Toe is moved inwards; if the outer, outwards. But if they both act together, then are the Toes extended. In the four diſtances between the bones, there are eight ſuch Muſcles; at the outſide of the great Toe one, and another at the outſide of the little Toe. But beſides *it*, the little Toe hath a proper *Abductor* to move it outwards, which ariſing from the Heel paſſes on the outſide of the fifth bone of the *Metatarſus*, and is inſerted into the outſide of the firſt joint or bone of this Toe.

One Extender of the Pollex or Great Toe.

The *great Toe* hath *five* peculiar or *proper* Muſcles. The *firſt* is *Extenſor* : this ſpringeth by a fleſhy beginning from the outſide of the *Tibia*, where the *Fibula* ſtands out from it : after a ſhort ſpace it paſſeth into a Tendon, which running under the annular ligament of the *Tarſus*, and marching along the upper part of the Foot, is inſerted into the whole upper part of the great Toe, which it extends.

One Bender.

The *ſecond* is *Flexor* : this ſpringeth from the upper and back part of the *Fibula*, and deſcending by the ſide of the *Flexor longus* to the inner Ankle, it there becometh tendinous, and running with the *longus* under that ligament there which tyeth the lower *Appendix* of the *Tibia* to the Heel, it is inſerted into the third or laſt bone of the great Toe, by one ſtrong Tendon, ſerving to bend it. But ſometimes it is divided into two Tendons, whereof one is inſerted as aboveſaid, and the other into the ſecond Toe : and when this happens, the *Flexor longus* ſends but three Tendons to the three laſt Toes, and none to the ſecond.

Three Movers ſideways.

1. The *three* following move it ſideways : of which the *firſt* is called *Abducens pollicem*, becauſe it draweth the great Toe from the reſt, toward the inſide of the Foot. It ſpringeth nervous from the Ligament which tieth together the Heel-bone and the *Talus* (or according to ſome, from the inner ſide of the Heel it ſelf) and running forwards on the inſide of the Foot, it is inſerted by a round Tendon into the outſide of the firſt joint of the great Toe.

The *ſecond* is called *Adducens pollicem major*, drawing the great Toe towards the reſt. This ſpringeth from the Ligament that ties thoſe two Bones of the *Metatarſus* together which ſuſtain the little Toe and the next to it, and proceeding obliquely over the other Bones it is implanted into the inner ſide of the firſt joint of the great Toe. 2.

The *third* is called *Adducens pollicem minor* (and otherwiſe *Tranſverſalis* from its running *a-croſs* the Foot.) This ariſeth from the Ligament that binds the firſt joint of the little Toe, and paſſing croſs the firſt bones of the other Toes it ends in the inſide of the firſt bone of the great Toe. Some think this ſerves onely to tie together the firſt bones of the Toes (like a Ligament:) But *Caſſerius* (who firſt found it out) ſays it draws the great Toe to the little one, and ſo makes the Foot hollow, graſping the ground as it were, when we go in ſtony and uneven places, to fix the Foot more firmly. 3.

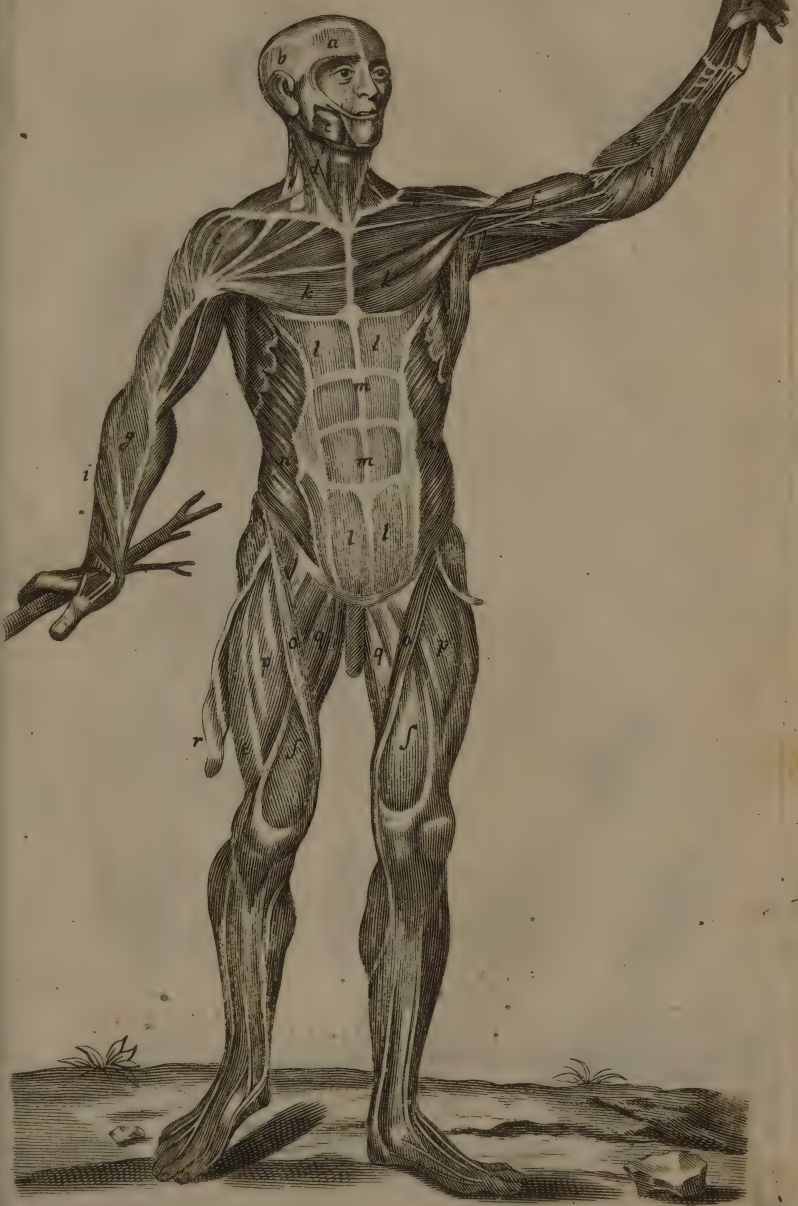
Having thus finiſhed our Diſcourſe of the Muſcles, I have thought fit to ſubjoin two Figures wherein are repreſented as many of the Muſcles as can conveniently be ſhewn in two poſtures of the Body. Which I have added, to let Beginners in this Art of Anatomy ſee the manner of the lying of the Muſcles in their natural Situation, and of the running of their Fibres.

Tab. XVI.

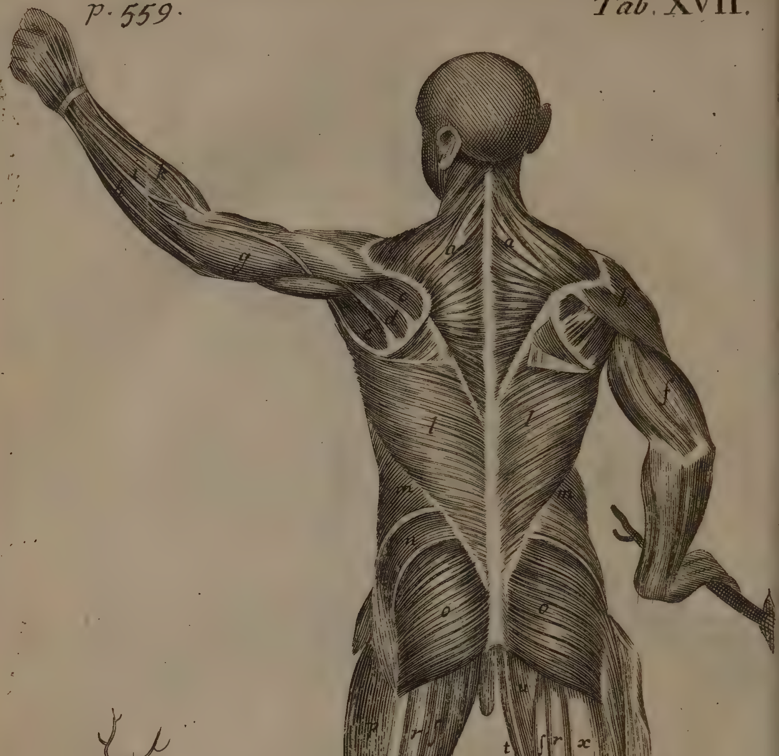
Repreſenteth the Muſcles as they lie to view in the fore-part of the Body.

a *Sheweth the Frontal Muſcle.*
b *The Temporal.*
c *The Muſcle called* Maſſeter.
d *The* Maſtoideus.
e *The* Deltoides.
ff *The* Biceps.
g *The Extender of the Wriſt.*
h *The Bender of the Wriſt.*
* *The Bender of the Thumb.*
i *The Extender of the third Joint of the Thumb.*
kk *The Pectoral Muſcles.*
llll *The ſtreight Muſcles of the* Abdomen.
mm *The* Linea alba.
nn *The obliquely deſcending.*
oo *The* Muſculus ſartorius *or* faſcialis.
pp *The ſtreight Muſcles of the Thigh.*
qq *The* Triceps.
r *Part of the* Membranoſus.
ſſ *The* Vaſtus internus.
t *The* Vaſtus externus.

Tab. XVI. *p.* 558.



p. 559. Tab. XVII.



Tab. XVII.

Repreſents the Muſcles as they lie to view in the hinder part of the Body.

a a *Shew the* Trapezius.
b *The* Deltoides.
c *The* Supraſpinatus.
d *The* Infraſpinatus.
e *The* Teres major.
f *The Extender of the Arm.*
g *The* Brachialis.
h *The outer Extender of the Wriſt.*
i *The other Extender of the Wriſt.*
k *The* Muſculus radii longus.
l l *The* Latiſſimus dorſi.
m m *The obliquely deſcending.*
n *The* Quadratus.
o o *The* Glutæus maximus.
p *The* Vaſtus externus.
q *Part of the* Membranoſus.
r r *The* Seminervoſus.
ſ ſ *The* Semimembranoſus.
t *The* Gracilis.
u *The* Triceps.
x *The* Biceps.
y *The* Subpoplitæus.
z z *The* Gaſtrocnemius.
α *The* Peronæus.

The End of the Fifth Book.

The Sixth Book.

OF THE BONES.

CHAP. I.

Of Bones in general, their conſtituent and integral parts.

Bones, their name.

A *Bone* is called in Greek ὀστέον, from ἵστημι, *to ſtand*; for according to *Hippocrates*, τῷ σώματι στάσιν, ϗ ὀρθότητα, ϗ εἶδος παρέχεται, *it affords ſtability, ſtreightneſs and form to the Body.*

Definition.

It may be defined to be a *ſimilar part, moſt dry, cold, and hard, inflexible, void of ſenſe, affording ſtabiliment and form to the whole Body.*

Matter and nouriſhment.

Bones have been commonly taught to be made of the more craſs, tartareous or earthy part of the Seed in the Womb, and that they are nouriſhed with the like particles of the Blood, and moiſten'd with their contained Marrow. And I ſee no reaſon to recede from this Doctrine, unleſs one would commence *litem de nomine*, brangle about a term: for though Women have no true Seed, and the Man's being only an active principle,

ciple of generation, affords nothing of matter to the parts of the *Fœtus*, but only impregnates the *Ovum*, (as was ſhewn in B. I.) yet if we will but grant the name of *Seed* to the humour in the *Ovum*, (which we may do without abſurdity) we may continue the old manner of ſpeaking. Now though they are continually nouriſhed, yet towards Manhood, by the increaſed heat of the Body, the primigenial moiſture is ſo leſſened, that the bones through their hardneſs are not apt to be any longer extended; and ſo Men ceaſe to grow any higher of ſtature.

As to the integral and conſtituent parts of Bones, their *Perioſteum* or inveſting Membrane, their *Pores*, *Marrow*, *Veſſels*, *Glands*, &c. Dr. *Havers* in his *Oſteologia nova*, has far outdone all former Anatomiſts in his account thereof, which is very worthy the peruſal of all that are curious in Anatomy. Thither therefore I refer the Reader, and ſhall here only exhibit a ſhort Scheme of part thereof. And firſt as to the *Perioſteum* that cloaths them.

Perioſteum. The *Perioſteum* (he ſays) "has two ſorts or ſeries of Fibres, the under deriv'd from the *Dura Mater*, the upper from the Membrane of the Muſcle that lies upon it: which Fibres lie one upon the other, but are not interwoven one with another.

"The under Fibres run all parallel directly from one end of the bone to the other, and are continued from one bone to another by means of the Ligaments that joyn them together in their articulations, upon which they paſs.

"The outer hold the ſame courſe with the Fibres of the Muſcle from whence they are derived, ſometimes ſtreight, ſometimes oblique,

" and ſometimes tranſverſe; and when they " have run ſo far as to make up their part of the " *Perioſteum*, he thinks they are inſerted into the " bone, and are ſucceeded by others from ſome " other Muſcle. Some of the Tendons of the " Muſcles alſo propagate Fibres to make ſome " part of the *Perioſteum*: but others penetrating " it are immediately inſerted into the bone.

" The inner Superficies of the *Perioſteum* ſticks " as cloſe to the bone as if it were glued to it; " and beſides, the *Perioſteum* has little *fibrillæ*, or " threads continued from it, that enter into the " ſubſtance of the bone, which give them (proba- " bly) ſome internal ſenſe.

Its Uſes. The *Uſes* he aſcribes to it, are, 1. " To be a tegument to the bones. 2. To convey Spirits in- " to the ſubſtance of the bones for maintaining " their heat, for preſerving their ſenſibility, and " to aſſiſt in the work of their accretion and nu- " trition, by means of the minute Fibres it immits " into them. 3. To help to ſet limits to the " growth and extenſion of the bones; as the " Bark is ſometimes obſerved ſo to bind young " Trees, that it is neceſſary to open it before " they can have the liberty of thriving. 4. It is " ſerviceable in the conjunction of the bones and " their epiphyſes, (while theſe are cartilagi- " nous) alſo of the bones which are joyned by " ſutures or harmony, and in the connexion of " the bones and their Cartilages. 5. To joyn " the Heads and Tendons of the Muſcles faſt to " the bones; namely, of ſuch Tendons as do not " penetrate it, (as ſome do not.)

The ſubſtance or make of Bones. Having done with the *Perioſteum*, he comes to the conſtituent parts of Bones, and deſcribes their ſubſtance or make in this manner. He ſays they "conſiſt of *Lamellæ* or Plates lying one upon "another, and theſe of ſmall ſtrings or Fibres "running lengthways of the Bones. Which "ſtrings though ſome of them run to the very "extremities of the Bones, and others ap"proach near to them, do not terminate there, "ſo as to have diſtinct ends, but they are, "where they may be thought to terminate, "ſtill continued, and run tranſverſly and as it "were arched, that the ſtrings of one ſide of "the Bone proceed ſo as to meet and be united "to thoſe that are propagated from the oppoſite; "and this at both extremities, that they are a "continuation, though not of the Figure, yet "in the manner of a Ring. Therefore they are "not all of a length, but in every Plate they "fall one ſhorter than another.

"In ſeveral Bones the *Lamellæ* are diſpoſed di"verſly: In thoſe Bones which have a large Cavi"ty, they are on every ſide contiguous and cloſe"ly united: But in thoſe which have not any "great Cavity, but are altogether ſpongious "within, many of the internal *Laminæ* are pla"ced at ſome diſtance from one another in all "their length, having betwixt them a cavernous "ſubſtance or ſmall bony cells. And ſo have al"ſo thoſe Bones which have a large Cavity, ſome "of theſe leſſer cells at both their extremities.

Their Pores. Next he comes to their *Pores*, and ſays, "That "in the Bones whoſe Plates are contiguous, there "are *Pores* through and between the Plates, be"ſides thoſe which are made for the paſſage of the "Blood-veſſels: And theſe are of two ſorts: "The one penetrate the *Laminæ*, and are tranſ"verſe, looking from the Cavity to the external "ſuperficies of the Bone; The ſecond ſort are

“ formed between the Plates, which are longitu-
“ dinal and ſtreight, tending from one end of the
“ Bone towards the other, and obſerving the
“ courſe of the bony ſtrings. The firſt kind are
“ formed not only in the firſt internal *Lamina*,
“ but in every one, even to the outermoſt; tho’
“ the nearer they are to the Cavity, the greater
“ is the number of the Pores. And as they paſs,
“ they do not obſerve any ſuch order as to lie di-
“ rectly one under another to form any continued
“ paſſage from the Cavity to the external Plate.
“ The ſecond kind, *viz.* the longitudinal, are
“ not to be obſerved but by good glaſſes, unleſs
“ it be now and then in ſome particular Bones.
“ By theſe it is that the medullary Oil diffuſes it
“ ſelf, and is immediately beneficial to the Plates.
“ The other (*viz.* the tranſverſe) are but ſubor-
“ dinate to theſe, and rather deſigned for the
“ paſſage of the Marrow into them, than for the
“ immediate communication of it to the ſubſtance
“ of the Bone.

The Marrow.

“ The *Medulla* contained in the Bones conſiſts
“ (beſides the Blood-veſſels) of an inveſting
“ Membrane, in which are included membranace-
“ ous lobules or bags, and in theſe bags *Veſiculæ* or
“ glandular bladders, very much like the veſicu-
“ lar ſubſtance of the Lungs. And theſe glandu-
“ lar bladders ſerve both for the ſeparation of the
“ medullary Oil from the Maſs of Blood, and for
“ the reception and conſervation of it. In an hu-
“ mane Bone which he had preſerved till the me-
“ dullar Oil was wholly evaporated, he found
“ theſe *Veſiculæ* remaining dry but intire, and
“ their ſubſtance repreſenting in a manner a
“ Sponge. They ſeem to have Pores or immedi-
“ ate paſſages out of one into another (as have

" alſo the bags) by which the Oil has a freer courſe " to the Joints, and Subſtance of the Bone, for " whoſe benefit it was deſigned. By the ſtricteſt " enquiry he could never find any thing like Ducts " (as paſs from other Glandules) and indeed theſe " are not here neceſſary, becauſe the Oil is not carried from the glandular Veſicles to any large receptacle, but flows out of the ſuperficies of the " Marrow in as many places, as there are tranſverſe Pores in the internal Lamel. The *Medulla* ſerves to oil the ſubſtance of every Bone, " which the drier it were, the brittler it would " be: It lubricates alſo their Articulations, and " hinders their ends from being worn, or overheated with motion; and it moiſtens likewiſe " the Ligaments by which they are tyed one to " another. But in theſe two laſt Uſes it is aſſiſted by the Mucilage which is ſeparated by the " *Glandulæ mucilaginoſæ* (as he calls them) which " he has obſerved in all the Articulations of the " Bones, and are of the conglomerate kind.

" Now the manner of the medullary Oil's inſinuating it ſelf through a Bone, and its being " diſpenſed to all the parts of it, is this: It firſt " paſſes being liquid (as it all is while the Animal is alive) out of the Cavity through the " tranſverſe Pores of the firſt internal *Lamina*, " and not having Pores of the ſame kind directly " ſubjacent in the next Plate to tranſmit it towards the outſide of the Bone, it flows into " the longitudinal ones formed between theſe " two (the firſt and ſecond) Plates, and being carried along in them till it find ſome tranſverſe " Pores in the ſecond Plate, it paſſes thro' theſe, " which when it has done, it is again obliged to " alter its courſe to run into and flow along the ſtreight Pores between the ſecond and third *Laminæ*. Thus it paſſes through and between the Plates ſucceſſively, till it has made its way to the external Plate.

“ Thus the medullary Oil is diſpenſed in all the Bones to thoſe Plates which are contiguous, and have no intermediate Cavities to entertain any medullary Glands of their own: But where the Plates ſtand at ſome diſtance (as they do in ſuch Bones as have not any great Cavity) there are the ſmall caverns (above-mentioned) which are capable of containing ſome medullary Glands, from whence the Plates have more immediately, and without the former method of conveyance, the benefit of the Marrow.

“ The Bones which have the large Cavities, are the *Os humeri*, and *femoris*, the *Ulna* and *Radius*, *Tibia* and *Fibula*, the Bones of the *Metacarpus* and *Metatarſus*, and of the *Os hyoides:* to which may be added the lower Jaw.

Veſſels.

“ He divides the *Blood-veſſels* of the Bones into *nutritious* and *medullary*. The moſt conſiderable of the *nutritious* enter at the ends of the Bone, *viz.* the Artery at one end, and the Vein at the other. The *medullary* commonly enter the ſides of the Bones (and that obliquely, as the Ureters do the Bladder) both by one *Foramen*.] There are no *Nerves* that are inſerted into them (except into the Teeth) but theſe only run through the *Perioſteum* that inveſts them.

Superficial Cavities and Foramina.

Beſides the large Cavities and Caverns in the inſide or ſubſtance of the Bones, ſome have *ſuperficial Cavities* or *Sinus's*, which Dr. *Havers* diſtinguiſhes into *Sulci* or Furrows (which are the long ones) and *Pits*, as he calls the ſhorter ones. And they have beſides, *holes* for the nutritious and medullary Veſſels, as was but juſt now obſerved.

Prominences, viz. On the outſide of the Bones there are alſo to be obſerved their *Prominences* or *Protuberances*, of which there be two kinds: for it is either a continued part of the Bone jetting manifeſtly above its plain Superficies, for the more commodious Inſertion of the Muſcles, *&c.* and is called *Apophyſis*, a *Proceſs*; or elſe it is like an additional Bone growing to another by ſimple and immediate contiguity, (and generally ſofter and more porous than it) and is called *Epiphyſis*, an *Appendage*. If the Protuberance of the Bone be round, it is called its *Caput*; under which is the *Cervix*, as in the upper end of the Thigh-bone: If it be flat, it is called *Condylus*: if ſharp, *Corone*. Other Protuberances or Proceſſes are named from the ſimilitude they have to other things, as *Styloides*, *Coracoides*, &c.

Apophyſis, *or* Epiphyſis.

Uſe. Their *Uſes* are many: for they ſerve 1. for the firmitude and ſuſtentation of the Body, like beams and pillars in houſes: 2. for a defence to ſome parts; ſo the Skull defends the Brain, the Ribs the parts contained in the Breaſt: 3. for progreſſion or walking, of which they with the Muſcles are the only Inſtruments: 4. they give ſhape to the parts of the Body. Theſe are their *general* Uſes; as to their *particular* Uſes, thoſe will be ſhewn as we deſcribe them ſeverally.

CHAP.

CHAP. II.

Of the different conjunctions of Bones one to another.

Bones are joyned to one another either by *Articulation* or joynting; or elſe by *Symphyſis* or growing together.

Articulation.

Articulation is either for *manifeſt*, or *obſcure* motion. The former is called *Diarthroſis*, becauſe the Articulation is looſe; the latter *Synarthroſis*, becauſe it is cloſe and compact.

1. Diarthroſis.

Diarthroſis, or that looſe joynting which ſerves for *manifeſt* motion, is threefold. Firſt, *Enarthroſis*, which is, when a large head of a Bone is received into a deep Cavity, as the Thigh-bone into the Hip-bone. Secondly, *Arthrodia*, which is when the Cavity which receiveth is ſhallow, and the head of the Bone which is received, flattiſh: ſuch is the Articulation of the *Radius* with the Shoulder-bone, or of the Shoulder-bone with the *Scapula*. The third is *Ginglymos*; when the ſame Bone receiveth, and is received. This falleth out three manner of ways. Firſt, when the Bone is received by another, and receiveth the ſame; this is ſeen in the Articulation of the Shoulder-bone with the *Vlna*. Secondly, when a Bone receiveth one Bone, and is recived by another: which is done in the Spondyls or *Vertebræ* of the Back, where the middle Bone receiveth the upper, and is received by the lower. The third is, when the proceſs of the Bone being long and round, is inſerted into another upper Bone, and ſo is turned in the Cavity like an Axle-tree in a Wheel; ſo is the ſecond *vertebra* of the Neck joynted with the firſt.

Note, That in all theſe Articulations are placed thoſe mucilaginous Glands above-mentioned, firſt diſcovered by Dr. *Havers*, and accurately deſcribed by him in his *Oſteologia nova*, p. 187, &c.

2. Synarthroſis. *Synarthroſis* or Articulation for *obſcure* motion, is ſuch as that of the Ribs with the *Vertebræ*, &c.

Symphyſis. Bones *grow together* either *without* ſome middle heterogeneous ſubſtance, or *with* it. *Without* ſome middle ſubſtance they are joyned three manner of ways. Firſt, by a ſimple line, as the Bones of the upper Jaw and Noſe; this is called *Harmonia*. Secondly, by a future, (or *Rhaphe*) as the Bones of the Skull. Thirdly, when one Bone is faſtned in another, as a Nail in Wood; and ſo are the Teeth faſtned in the Jaw-bone: this is called *Gomphoſis*.

If Bones grow together *by* a middle ſubſtance, it is either by a *Cartilage*, as the Share-bones are joyned; which unition is called *Synchondroſis:* or by a *Ligament*, and ſo the Thigh is joyned with the Hip-bone; this is called *Synneuroſis*, or more properly, according to *Spigelius*, *Syndeſmoſis:* or laſt of all by *Fleſh*, and ſo is the Bone of the Tongue by its Muſcles to the adjacent parts; this is termed *Syſſarcoſis*.

Spigelius reckons two other heterogeneous middle ſubſtances by which Bones are united; one when they are joyned by a *Tendon*, as the Knee-pan to the Thigh-bone and *Tibia*, which unition he calls *Syntenoſis*; the other by a *Membrane*, as in Infants the Bones of the *Synciput* with the *Os frontis*; and this he calls *Synymenſis*.

CHAP. III.

Of the Skull in general.

WHEN all the Bones of the Body are artificially joined to one another and ſeated in their proper places, the whole ſtructure of them is called a *Skeleton*, from σκέλλω, *to dry*, becauſe they are then void of all moiſture.

This *Skeleton* is commonly divided into the *Head*, *Trunk* and *Limbs*.

The *Head* is again divided into the *Skull* or *Scalp*; and the *Face*.

The Skull. Its Name.

The *Skull* is called in Greek κρανίον, *Cranium*, becauſe it defends the Brain *tanquam* κράνος, like an *helmet*; and in Latine *Calvaria*, *qu. calva capitis area*, becauſe it comprehends all that part of the Head upon which the Hair grows, and which is ſaid to be *bald* when the Hair falls off.

Figure.

Its *Figure* is globous or round, but not exactly, for it bunches out a little before and behind, and is more flat on the ſides, ſo that it is ſomewhat longiſh. The more it varies in any particular Perſons from this ſhape, the more preternatural is its figure. Some raiſe a nice queſtion concerning its ſhape, whether it be owing to that of the Brain included within it, or whether the ſhape of the Brain be owing to this of the Skull. 'Tis true, that they anſwer one to the other in Figure, but whoſe is owing to the others is needleſs to enquire; nor ſhall we ſpend time in ſuch a fanciful Diſpute.

Subſtance. In an Embryo its *Subſtance* is membranous, in Infants new-born 'tis bony, but ſoftiſh and flexible; but it grows harder and harder by degrees (like the other Bones) yet continues ſpongie in its middle.

Tables. It conſiſts of two *Laminæ*, Plates or Tables, (ſo called) the outer thicker and ſmoother, but the inner harder and furrowed on its inner ſuperficies, to give convenient and ſafe paſſage to the Veſſels that creep through the *Dura Mater*: yea in ſome places it is perforated for the tranſit of Veſſels from the ſaid *Meninx* to betwixt the *Laminæ* for the irrigating of the Pith that lies between them.

Diploë. Which Pith is called *Diploë*, and is a ſpongie and cavernous ſubſtance containing a medullar and ſomewhat bloody juice for the nouriſhment of the Skull. It is more porous in young Bodies than in old; and in ſome places of the Skull than in others: for in ſome the two Tables grow ſo cloſe together that 'tis hardly diſcernible.

Diemerbroeck writes that he has ſometimes obſerved (eſpecially in Venereal Perſons) a vicious Humour collected in this ſpongie Pith, which in tract of Time becoming more acrimonious and virulent, has eat through the very Tables, eſpecially the outer which is ſofter, and cauſed moſt tormenting pains in the *Perioſteum* and *Pericranium*; yea ſometimes the inner alſo, and ſo the whole Skull has been perforated.

CHAP.

CHAP. IV.

Of the Sutures of the Skull.

BEfore we come to deſcribe particularly the Bones which the Skull conſiſts of, we will treat in ſhort of their ſeveral manners of commiſſure or connexion one with another, or with thoſe that are contiguous to them, *viz.* the upper Jaw and the three Bones that are common to the Skull and upper Jaw, *viz.* the *Jugale*, *Cuneiforme* and *ſpongioſum*, or laſtly, of theſe common Bones with thoſe next to *them.*

Sutures are proper, or common.

Their connexions among themſelves and alſo with theſe other Bones, are both called *Sutures* (or Seams:) and theſe are divided into *proper*, or *common.*

Proper Sutures true, or counterfeit.

The *proper* are thoſe which join the Bones of the Skull one with another; and are either (*veræ*) *true* Sutures, or (*mendoſæ*) *counterfeit.*

Three true.

The *true* are when two Bones being mutually indented, cloſe one with the other, as if two Saws were joined together by their Teeth; whence they are called *ſerratæ:* and theſe are *three* in number: the *firſt* is *Coronalis*, which is ſeated in the fore part, and paſſeth from one Temple to the other tranſverſly, joining the *Os frontis* to the *Synciput.* The *ſecond* is *Lambdoides*, oppoſite to this, reſembling the Geek letter Λ *Lambda.* This beginning at the *Baſis* of the *Occiput* aſcends obliquely to either Ear, and joins the Bone of the *Occiput* to the Bones of the *Synciput* and Temples. The *third* is *Sagittalis*, which beginning at the top of the *Lambdoides*, comes ſtreight forward by the Crown to the middle of the *Coronalis*, and in Children for ſome years (ſometimes in the adult) it runs to the top of the Noſe, dividing the bone of the Forehead into two. *Spigelius* notes, that theſe true Sutures are only in the outward *Lamina*, the inner being joyned only by *harmonia*.

Two counterfeit. The *counterfeit* or *mendoſæ* reſemble a line only, and are more properly called *Harmoniæ* than Sutures. *Spigelius* reckons *five* of them, others more, but the chief of them are but *two*. The *firſt* paſſing from the root of the *Proceſſus mammillaris* upwards, with a circular Duct circumſcribes the Temple-bone, and deſcends down again to the *baſis* of the Ear: this Suture joyns the bones of the *Synciput*, *Occiput*, and *Sphenoides* with the Temple-bone, this lying upon thoſe like the Skales upon Fiſh, whence this Suture is called *Squamoſa*. The *ſecond* runs from the top of this ſquamous conjunction obliquely downwards towards the Orbit of the Eye, to the beginning of the firſt common Suture, and joyns this bone *above* with the bones of the *Synciput*, and *below* with the bone of the Forehead.

Common Sutures. The *common* ſutures are thoſe whereby the bones of the Skull (as alſo the common bones) are joyned to thoſe which are contiguous to them. And of theſe by *Diemerbroeck* there are reckoned *five*. The *firſt* is that by which the outer proceſs of the *Os frontis* is joyned with the firſt bone of the upper Jaw. The *ſecond* is ſeated in the outer and lower part of the Orbit of the Eye. The *third* aſcends obliquely from the inſide of the Orbit to the top of the Noſe. The *fourth* proceeds obliquely by the middle of *Os jugale*, joyning it,

(or rather the firſt bone of the upper Jaw) to the Temple-bone. The *fifth*, below in the cavity of the Noſtrils, tends from behind forwards : *Spigelius* ſays, this is common to the *Os cuneiforme* with the *Septum* of the Noſe.

The uſes of the Sutures.

The *Sutures* have *three uſes.* The *firſt* is to help to ſtay the Brain from ſhogging , and its parts from being miſplaced in violent motions, by permitting ſome Fibres to paſs through from the *Dura Mater* to the *Pericranium*, (or from this to that) by which the ſaid *Mater* and the Brain inveſted in it are ſuſpended as it were. The *ſecond* is to permit the Vapours and Fumes of the Brain to evaporate. And the *third*, to hinder the Fiſſures that happen in the Skull from knocks or falls, *&c.* from extending any farther than through one bone, for they generally ſtop at the next Suture.

CHAP. V.

Of the proper Bones of the Skull.

Six proper bones of the Skull.

THE Bones *proper* to the Skull are in number *ſix*, one of the Forehead, another of the *Occiput*, two of the Crown, and two of the Temples.

1. Os frontis.

Firſt , *Os frontis*, the Forehead-bone. It is bounded by the Coronal and firſt common Suture, before ; and in the ſides by the temporal Bones. It is but one in thoſe of ripe age, but double in Children, being divided by a Suture paſſing down its middle from the Coronal to the Noſe.

Its Cavity.

Betwixt the *Laminæ* of this Bone at the top of the Noſe, there is a large Cavity or Cavern, (often two) from whence two holes paſs to the Noſtrils. The outer *Lamina* that conſtitutes this Cavity, makes the upper plane part of the orbit of the Eye; but the inner, on each ſide above the Eyes forms a bunchy protuberance uneven with many jettings out like little Hills. The Cavity is inveſted with a very thin greeniſh Membrane, and contains a clammy humour. What its uſe may be, is hard to ſay; ſome think it gives an Echo to the Voice, making it more ſonorous; others that it receiveth the odoriferous air drawn in by the Noſe, to ſtay it awhile before it be ſent to the Brain. But theſe ſeem but vain conjectures.

Holes and Pores.

It hath two *holes* in the middle part of the Eyebrow, which come from the orbit of the Eye, by which the firſt branch of the Nerve of the fifth conjugation of the Brain goes to the Muſcles of the Forehead, *&c.* Beſides theſe more manifeſt holes, Dr. *Havers* has obſerved “in this Bone, and in “the Bones of the *ſynciput* at thoſe Angles which “meet in the coronal ſuture, and all along on “both ſides the *ſutura ſagittalis*, numerous *Pores* “penetrating into their ſubſtance, which he con“ceives to be *perſpiracula*, by which the offenſive “vapours, which ariſe and gather within the “*Cranium*, do perſpire. Which Opinion, ſays “he, may ſeem the more probable, if we conſider “how ſweats do eaſily and frequently ariſe in the “Forehead, even when they are not diſcernable “in other parts, to account for which we may “reaſonably ſuppoſe that there is ſome other way “of evacuation, beſides what is made from the “maſs of bloud by the cutaneous Glands, which “are to be found in any part of the Skin as well “as there.

Proceſſes.

It hath alſo four *proceſſes*; the greater two are ſeated at the greater corner of the Eye, and the leſſer two at the leſſer, making the upper part of the orbit.

2, 3. *Two Bones of the* Synciput.

The Bones of the *Synciput* or Crown are in number two. Before, they are joined with the Bone of the Forehead by the Coronal ſuture; behind, with the *Os occipitis*, by the *Lambdoides*; on each ſide to the Temple-bones, by the *Suturæ ſquamoſæ*; and to one another in the middle of the Crown, by the ſagittal Suture. On the outſide they are ſmooth, but on the inſide uneven, for they have a great many furrows running along their inner *ſuperficies* for the paſſage of the Veins of the *Dura mater.* Their ſubſtance is thinner and more rare even in the adult than that of the other Bones (for the better exhalation of vapours) but in Infants that abound with much humidity, they are membranous and ſoft, hardening by degrees.

4, 5. *Two Temple-Bones.*

Below theſe on each ſide are the Bones of the *Temples.* They are joined in their upper part to the outſide of the Bones of the *Synciput* by the *Suturæ ſquamoſæ*; before, to the proceſs of the firſt Bone of the upper Jaw; behind, to the *Os occipitis*, by a counterfeit Suture. Theſe Bones are even and thin in their upper part, like a Skale, (and conſiſt but of one *lamina*) but below thick, hard and unequal or craggy; wherefore they are called *Petroſa.*

Each has two ſinus.

They have each two *Sinus*; the *outer* greater, lined with a Cartilage, betwixt the *Meatus auditorius* and the proceſs that makes part of the *Os jugale*; this receives the longer proceſs of the lower

lower Jaw: the *inner* leſs, common to it with the Bone of the *Occiput*, placed on the hinder ſide of the firſt named Proceſs.

One Appendix, viz. Styloides. By theſe *Sinus* there ſtands a ſlender, ſharp and longiſh *Appendix*, from its Shape called *Styliformis*, which in Infants is cartilaginous, but in the adult becomes bony.

Three Proceſſes. Beſide this *Appendix* they have three *Proceſſes*, two *external* and one *internal*.

1. Proceſſus mammillaris. The *firſt external* is blunt, thick and ſhort, a little hollow within, and becauſe it ſomewhat reſembles a Cow's Pap, it is called *Mammillaris*.

2. The *ſecond* is carried forward from the *Meatus* of the Ear, and is joined with the firſt Bone of the upper Jaw, both of them framing the *Os jugale*, of which in the next Chapter.

3. Petroſus. The *third*, that is *internal*, is called *Proceſſus petroſus*, and *Os petroſum*, from its hardneſs and cragginеſs. It is pretty long, jetting out to the inner *Baſis* of the Skull, *within* which it has two Holes, through one of which an Artery, and through the other the auditory Nerve paſs to the inner Cavities of the Ear, that are excavated in this Proceſs, namely the *Tympanum*, *Labyrinthus*, and *Cochlea*; and *without* the Skull it hath three holes; the firſt of which is the *Meatus auditorius*; the ſecond is narrow, ſhort and oblique, near to the firſt, by which the Jugular Vein enters the inner Cavities; the *third* is ſeated betwixt the *Proceſſus Mammillaris* and the *Styloides Appendix*, and ends into that paſſage that goes from the Ear to the Mouth.

As to the four little Bones that are contained in its firſt inner Cavity, *viz. Incus*, *Malleus*, *Stapes* and *Os orbiculare*, we have ſpoken of them before in *Book* III. *Chap.* 23.

The *Os occipitis*, that makes the hinder and lower part of the Head, 'is five-corner'd, by two of which corners it is joined in its upper part to the Bones of the *Synciput* by the *Lambdoides* Suture, by two other in its foreſides to the Temple-bones by a counterfeit or ſquamous Suture, and by its fifth corner to the *Os cuneiforme*. It is but one in the adult, but it conſiſts of four or more in Infants. It is the thickeſt and moſt compact of all the Bones of the Skull. 6. Os occipitis.

It is ſaid to have nine *Sinus*, two external, and ſeven internal. The external are one on each ſide of its great hole behind, by which the ſpinal Marrow deſcends. Of the internal the two largeſt are thoſe that receive the Protuberances of the *Cerebellum*. *Its* Sinus.

It has alſo five *Protuberances* or *Proceſſes*, four of which are by the ſides of the great *Foramen* aforeſaid, and being all covered with a Cartilage are received into the *Sinus's* of the firſt *Vertebra*, ſerving for the articulation of the Head: the fifth is larger than theſe, aſcending inwards from the great *Foramen*, and parting the Protuberances of the Cerebel. *Proceſſes.*

Laſtly, It has five *Foramina*, of which the loweſt and largeſt is that by which the *Medulla oblongata* paſſes out of the Skull into the *Vertebræ*. The reſt are leſs, and are for the tranſit of the Veſſels. *Holes.*

CHAP.

CHAP. VI.

Of the Bones common to the Skull and upper Jaw.

Three common Bones. 1. Os Cuneiforme. *Lib.* 1. *de catarrhis*, p. 167.

Hitherto of the Bones *proper* to the Skull: Now follow thoſe which are *common* to it and the upper Jaw. Theſe are *three*: *Firſt*, *Sphenoides* or *Cuneiforme*, the wedge-like Bone; ſo called, quoth *Schneider*, “ Not for the propriety “ of its figure, for it endeth in a blunt point; nor, “ as many think, only upon the account of *Sciſſion* or cleaving; but eſpecially with reſpect to “ *an Arch* (of which this is the *Cuneus* or Wedge.) “ For the Bones of the Forehead, *Synciput*, Temples and *Occiput* make the ſides of the Arch, “ and this Bone of which we ſpeak, does like a “ *Wedge* fill up that ſpace that lies betwixt thoſe “ riſing ſides.] Before, it is joined with the Forehead-bone; behind, to the *Os occipitis*. At the ſides it doth accompany a good way the *Os petroſum*. Above, it doth touch the firſt, fourth and ſixth Bone of the upper Jaw; and below, the Bones of the Palate of the Mouth by its wing-like Proceſſes. It is thick in the middle, but thinner at the edges, and in the adult it conſiſts of two *Laminæ* and a *Diploë*, like the other Bones proper to the Skull. In Infants it conſiſts of three or four.

Its Proceſſes.

It has four *external Proceſſes*, of which two, that are contiguous to the upper Jaw, are called *Pterygoides*, *Aliformes* or Wing-like; and four *internal* alſo, which with the ſpace betwixt them compoſe the *Sella equina* or *Turcica*, upon which the

Sella Turcica.

Glandula pituitaria lieth, that receiveth the pituitous excrements falling from the Brain by the *Infundibulum.* Of this *Sella* and its ſubjacent Cavity *Schneider* thus writes. “ In that *Sinus* that is *Idem* ib. p.209, &c. called *Sella equina* a certain Cavity lyeth under the upper *Lamina* of the *Os cuneiforme.* In the Skull indeed of an Infant, this Cavity is always naturally abſent (for in theſe the Bone in that place is fungous:) But after the Infant is a year old (as *Fallopius* teaches) it begins to be made, and according to the encreaſe of the Bone is greater or leſſer. A thin skin cloaths this Cavity, which is not of a green colour, as *Bauhinus* teaches; but is very thin, ſoftiſh and whitiſh----This *Antrum* (or Cavity) and the like are formed by Nature to the end the Skull ſhould not be too ponderous ----- Nothing but Air is contain'd in it.... In ſome Skulls it is wanting.

Moſt of the more ancient Anatomiſts ſpeak of *Holes.* ſeveral *Holes* in this Bone for the tranſit of ſuch pituitous humours (into the Noſtrils or Palate) as fall upon, or are ſeparated by the *Glandula pituitaria.* But as we intimated from Dr. *Lower* in *Book* III. *Chap.* 5. there are no ſuch *Holes* in it for that office, but thoſe excrements are reſorbed by the Veins, as that Learned Doctor affirms. Yet it hath ſundry Perforations for other purpoſes, *viz.* for the paſſage of the motory and optick Nerves of the Eye, and of other Nerves for the motion of other parts, as alſo of Veins and Arteries.

It has divers *Sinus:* Outwardly or below it has Sinus. one in each wing-like Proceſs, giving room to the *Muſculus pterygoides* (or *pterygoſtaphilinus*) *internus*; (or rather to Dr. *Croone*'s *pterygopalatinus.*) Inwardly or above, it has one large one called *Sella equina*, before deſcribed out of *Schneider*: and two or three ſmall ones.

2. Os cribriforme. The *ſecond common* Bone is *Os cribriforme*, becauſe like a Sieve it hath many holes, by which the filaments of the olfactory Nerves or *Proceſſus mammillares* paſs into the Noſtrils. It is ſeated in the middle *Baſis* of the Forehead at the top of the Noſtrils, and is covered with the *Dura Mater* which accompanies the nervous filaments aforeſaid through the holes. It is joined by the Sutures called *Harmoniæ* to the *Os frontis*, the ſecond Bone of the upper Jaw, and to the *Cuneiforme*.

Its Proceſſes. On its upper ſide in the middle it has growing upon it a kind of triangular *Proceſs*, like to the Comb of a Cock, which is therefore called *Criſta Galli*. And oppoſite to this in its lower ſide it has another that is thin and hard, dividing the Noſe into two parts or Noſtrils, the right and the left, and is called *Septum naſi*.

Oſſa ſpongioſa. To this *Os cribriforme*, in the cavity of the Noſtrils, there adhere two other Bones called *Spongioſa*, becauſe they are full of caverns or holes like a *Sponge* or Pumice-ſtone. But moſt Anatomiſts conſider them as parts of the *Os cribriforme*, confounding their names one with the other, calling this, *Os ſpongioſum*, or *cribriforme* indifferently.

3. Os jugale. The *third common* Bone is (from its ſhape) called *Os jugale*, or the Yoke-bone. This indeed is not truly a diſtinct Bone, but is made up of one Proceſs of a bone of the Skull, and of another of the upper Jaw: But becauſe it has a diſtinct name, and is common to the Skull and upper Jaw, as partaking of both, we therefore reckon it for a diſtinct *common* Bone. I ſay it is made up of two Proceſſes, of which the hinder is a Proceſs of the

Temple-bone that is carried from the *Meatus auditorius* forwards; and the fore one is a proceſs of the firſt bone of the upper Jaw, that maketh the lower ſide of the outer corner of the Eye, which reaching backwards meets the other, and is joyned to it by an oblique Suture, and ſo makes the *Os jugale.*

Its ſituation and uſe.

By which deſcription of this Bone, its *ſituation* appears to be on each ſide of the Face betwixt the *Meatus auditorius* and the firſt bone of the upper Jaw: and its principal uſe ſeems to be for defence of the Tendon of the temporal Muſcle, and to give riſe to one of the Heads of the Muſcle *Maſſeter.*

CHAP. VII.

Of the upper and lower Jaws.

THus far of the Bones of the *Calvaria*, or *Scalp*: next follow thoſe of the *Face*, which are the *Jaw-bones* with their *Teeth*; to which we ſhall ſubjoyn the *Bone of the Tongue.*

The Jaw-bones are two, the upper and lower.

The *Jaws* are two, the *upper* and *lower.*

The upper conſiſts of 12. bones.

The ſubſtance of the *upper* Jaw, eſpecially on its inſide, is not ſolid but ſpongious; and unequal, becauſe it is framed of ſundry Bones. They are ſix pair, ſix in each ſide. The *firſt* is almoſt triangular, ſeated on the lower ſide of the outer corner of the Eye, and by its proceſs maketh up the beſt part of the *Os jugale* as was ſhewed in the former Chapter. The *ſecond* is a round, little, and thin bone in the inner corner of the Eye, having an hole in its lower part, called *Foramen* *lachrymale*, upon which the *Glandula* or *Caruncula lachrymalis* reſteth, and through which a branch of the fifth pair of Nerves paſſeth to the inner Membrane of the Noſe. The *third* is thin as the former, but quadrangular. It is placed between the two former in the inner-ſide of the Orbit of the Eye. The *fourth* is called *Os malæ*, the Cheek-bone, and is the greateſt and thickeſt. This maketh up the greateſt part of the Cheek and Palate, and containeth all the upper Teeth in its Caverns. It is joyned above, on that ſide next the Noſe, to the bone of the Forehead, but below with the wedge-like bone; before, with the ſecond bone of the upper Jaw, behind with the third, and laſt of all with its fellow. Under the Eye it has a hole for the paſſage of a branch of the fifth pair of Nerves that is beſtowed on the Face; and another near the bottom of the Noſe, by which an Artery and a Vein paſs from the Palate to the Noſtrils. The *fifth* is long, hard, and reaſonable thick; it with its fellow maketh up the bony part of the Noſe. It is joyned with the Cartilages of the Noſe below, (to which purpoſe it is very rough on that ſide) but to the internal proceſs of the *Os frontis* above. The *ſixth* is broad and thin, and (with its fellow) makes the Roof of the Mouth.

The Orbit of the Eye, how formed.

Note, that the under-ſide of the Orbit of the Eye is formed by the firſt, ſecond, third, and fourth of theſe bones of the upper Jaw, and the upper-ſide by the *Os frontis:* only the *Os cuneiforme* makes up a little part in the hinder-ſide of the outer corner.

The lower Jaw conſiſts but of one bone.

The *lower* Jaw in thoſe of ripe age is but one Bone, but in Children, till they are a year or two old, it conſiſts of two, which are joyned together at the Chin by *Synchondroſis*, and afterwards grow into one. This is moveable, but the upper immoveable. It reſembleth in ſhape the Greek letter *υ*.

Its proceſſes.

At each end of it there are two *proceſſes*, whereof the one from a broad *baſis* grows ſharp, and is called *Corone*, going under the *Os jugale*, and having the Tendon of the temporal Muſcle firmly inſerted into it. The *other* may be called *Articularis*, becauſe it ſerveth for Articulation. This has a long Neck and a longiſh but flattiſh Head (or *Condylus*) that is covered with a Cartilage for its eaſier motion. By this Head it is inarticulated into the larger *Sinus* of the *Os temporis* that is alſo lined with a Cartilage, and is knit ſtrongly thereto by a membranous Ligament.

Cavity.

This Bone has a *cavity* within, eſpecially in the fore-part toward the Chin, which contains a marrowy juice for its nouriſhment.

Holes.

It has four *Foramina*; of which *two* are at the roots of the Proceſſes, by which a branch of the fifth pair of Nerves together with a Vein and Artery paſs to the Teeth (as ſhall be ſhewn further in the next Chapter) and *two* other in its fore-part by the ſides of the Chin, by which two twigs of the ſaid fifth branch paſs out again to the lower Lip and its Muſcles and Skin.

Surface.

Its *Superficies* is ſmooth for the greateſt part, but in ſome places there are aſperities for the firmer inſertion of the Tendons of its Muſcles, as was ſhewn in the deſcription of thoſe Muſcles.

The Alveoli of both Jaws. Both the Jaws have *Alveoli* or Sockets for the Teeth, in number equal with the number of the Teeth. But when in old age the Teeth fall out, the Sockets cloſe together, ſo that in time there remains no print of them, but the bone becomes ſmooth and ſharp.

CHAP. VIII.

Of the Teeth.

The Teeth, their name and articulation. THE Teeth are called in Latine *Dentes*, quaſi *Edentes*, from their office of *eating*. They are fixed in their *Alveoli* three manner of ways: the firſt and chief is by their Articulation with the Jaw-bones, by *gomphoſis*; the ſecond is by the Nerve which is inſerted into their root, by *Synneuroſis*; and the laſt is by the Gums which cleave to the outſide of their roots by *Syſſarcoſis*.

Subſtance. Their *Subſtance* is the hardeſt of all other Bones, but more eſpecially that part of them that ſtands out naked above the Gums. This part Dr. *Havers* thinks ought to be eſteemed rather ſtony than bony, and yet not the whole of it neither, but only the outſide or *cortex*, which like a Shell covers the bony, which being broken off or decayed, the bony quickly rots and moulders away. This part of the Teeth is not covered with any *Perioſteum*; but that part which is within the Sockets of the Jaw-bones is inveſted with a thin Membrane, which he ſays, "is not the true *Perioſteum* (though "that inveſts the Socket wherein they ſtand) "but is propagated from that Membrane that "covers the Gums, and is common to the whole "Mouth, which does not terminate with the "Gums, but when it comes to their extream "edge, turns in, and is reflected between the "other ſide of the Gum and the Tooth, deſcending "into the *Alveolus* or Socket, and adhering "immediately to thoſe parts of the Teeth which "lie within.] By the means of this, and the Nerve inſerted into the root of every Tooth, theſe lower parts of the Teeth become exquiſitely ſenſible.

Cavity and Veſſels. The Grinders have a manifeſt *Cavity* within, (but the *Inciſores* and *Canini* but an obſcure one) whereinto by the very ſmall holes of their roots they each receive a Capillary Artery from the *Carotides*, a Vein from the Jugulars, and a twig of a Nerve from the fifth pair (as aboveſaid.) The Vein, Artery, and Nerve are united together and clad with a common Membrane when they enter the Jaw, within which they have a proper Chanel to run along in under the roots of the Teeth, ſending twigs to each as they paſs under them.

Principle. The Rudiments or *Principles* of the Teeth are bred with the other parts in the Womb, but lie hid for ſome Months within the Jaws and Gums. Theſe Principles are partly bony and partly mucous, and both parts are at firſt included in a membranous and ſomewhat mucous *Folliculus* or caſe, which in proceſs of time they break through (ſome ſooner, others later) their bony part aſcending upwards out of the Gums, and their mucous part (hardening by degrees) deſcending downward into the Jaw ſo far as there is ſpace for it; the *Folliculus* it ſelf turning to a kind of

Cement, whereby the Tooth is faſtened to the ſides of the *Alveolus.*

Eruption and growth. At what time and in what order they *break forth* out of the *Alveoli*, is known to every Nurſe: omitting therefore to ſpeak of that, I ſhall only note, That the Teeth alone, of all the bones in the Body, continue to *grow* ſo long as a Man lives, (and they continue in his Head) for elſe would they be ſoon worn to the ſtumps by their daily uſe; and we ſee that when a Tooth is loſt out of either Jaw (in the oldeſt people) that which is oppoſite to it in the other Jaw, will grow longer than the reſt, having none to grind againſt.

Change. When Children come to be ſeven or eight years old, they *change* ſeveral of their Teeth; but very rarely, if ever, all. The *Inciſores* or Fore-teeth, the *Canini*, or Eye-teeth, and the foremoſt Double-teeth moſt change; but the reſt of the Double-teeth very few. Now concerning this changing of the Teeth, we muſt know, that the old ones do not come out by the roots, but their upper part only drops off, their root remaining ſtill in the Socket of the Jaw, which (being like Seed for the new ones) by degrees grows up above the Gums to ſupply the place of that which was fallen off.

Dentes ſapientiæ. Commonly about the twentieth year (or upwards) there ſpring out two Double-teeth behind the reſt, which till then had lain hid in their Sockets. Theſe are called Genuine Teeth, or *Dentes ſapientiæ*, becauſe Men are then come to years of diſcretion.

Number. As for the *number* of them, commonly there are found ſixteen in each Jaw; if there fall out any difference in number as to individual perſons, it generally falleth out in the *Molares.*

There are *three* ranks or ſorts of Teeth. *Sorts.* Thoſe of the *firſt* rank (or the foremoſt) are called *Inciſores*, Cutters. Moſt commonly four are found in each Jaw: they have but one Root or Phang, and ſo eaſily fall or are pulled out. Theſe firſt make way out of the Gums in Children, becauſe the tops of them are ſharpeſt. Thoſe of the *ſecond* rank are called *Canini*, or Dog-teeth, from their length, hardneſs and ſharpneſs above the reſt. In each Jaw there are two, at each ſide of the Cutters one. They are otherwiſe called *Eye-teeth*, either from an Opinion that their roots, (*viz.* of the upper) reach as far as the Eyes, or that the ſame Nerve that moves the Eye ſends a twig to theſe Teeth; neither of which conceits are true. The roots of theſe are ſingle as thoſe of the *Inciſores*, but they are both ſometimes crooked; and if ſuch people in whom they are ſo, chance to have one of them drawn, they can hardly be pulled out without breaking off a piece of the *Alveolus* in which they are fix'd. Thoſe of the *third* rank are called *Molares*, Grinders; becauſe like Milſtones they grind the Meat. Moſt commonly they are twenty in number, five in each ſide of both Jaws. The two foremoſt that ſtand next to the Dog-teeth, are leſs than the reſt, having but two knobs at the top, but the three hindmoſt are larger and have four, being in a manner fourſquare. The two foremoſt alſo have but two roots at moſt, but the three hindmoſt commonly three or four. But thoſe of the upper Jaw have for the moſt part one root more than thoſe which are oppoſite to them in the lower, or however their roots are larger. The reaſon whereof may be, firſt, becauſe they are pendulous, and ſo are the apter to drop out; and ſecondly, becauſe the ſubſtance of the upper Jaw is not ſo firm as that of the lower.

Uſe. The *uſe* of the Teeth is principally to chew the Meat to prepare it for the Stomach, that it may the eaſilier concoct it into Chyle. The *Inciſores* bite off the Morſel, the Dog-teeth break it, and the Grinders make it ſmall; wherefore they are flat in the top, that they may the better receive and keep the Meat; and rough, that they may grind it the better. The Teeth contribute alſo to the formation of the Speech, eſpecially the Fore-teeth; for thoſe that have loſt them, liſp as we ſay, and cannot pronounce plainly ſuch ſyllables as have C. X, &c. in them.

CHAP. IX.

Of the Bone of the Tongue called Os Hyoides.

Os hyoides, *its ſituation and ſhape.* THE *Os hyoides* is ſeated at the root of the Tongue under the lower Jaw, and above the *Larynx*. It is ſhaped like the Greek Vowel υ, (whence it is alſo called *Os Ypſiloides*) or like the lower Jaw, being arched before, and extending its two points or horns backward.

Parts. It is commonly compounded of three Bones. That in the middle is gibbous forwards and hollow inwards; by its gibbous ſide it is joyned to the *baſis* of the Tongue, and into its concave it receives the *Epiglottis*. The other two are lateral, and are called *Cornua*, or Horns. Each of theſe has a Cartilage adhering to it; and the middle, two. They are all tied to the adjacent parts, partly by a fleſhy, partly by a nervous or membranous ſubſtance.

Uſe. It ſerves for the inſertion of ſeveral of thoſe Muſcles that are deſigned to move the Tongue, (deſcribed Book V. Chap. 10.) and alſo for keeping the Throat open, that the Meat may have paſſage out of the Mouth into the Stomach, and the Air into and out of the Wind-pipe, while we ſpeak and breath.

CHAP. X.

Of the Bones of the Neck, viz. the Claviculæ *and* Vertebræ.

Hitherto of the Bones of the *Head*; we ſhould next proceed to thoſe of the *Trunk* (according to our diviſion of the parts of a *Skeleton*:) but betwixt theſe lieth the *Neck*, whoſe bones we muſt deſcribe in our way.

Theſe are of two ſorts, to wit, the *Claviculæ* or Chanel-bones, and the *Vertebræ*.

Claviculæ, *their ſituation, figure, ſubſtance, number, and connexion.* As to the *Caviculæ*, ſome reckon them to the *Thorax*, others to the Shoulder; but conſidering their *ſituation*, they may as fitly be reckoned as pertaining to the Neck. They are called *Claviculæ* from their reſembling the ſhape of old-faſhioned Keys, which were of the figure of an Italick *ſ*; ſuch as *Spigelius* ſays he has ſeen belonging to old Houſes at *Padua*. They are not ſo crooked in Women as in Men. Their *Subſtance* is thick and ſpongie, but more about the heads than about the middle. In *number* they are two, one on each ſide. Near the Throat they are round; but towards the Shoulder flattiſh. They are *joined* to two Bones, to wit, by one end to the Shoulder-blade, and by the other to the top of the Breaſt-bone.

Uſe.

Their *Uſe* is to uphold the Shoulder-blades, that they ſhould not ſlide down upon the Breaſt together with the Shoulder-bone; which falleth out, when there happens a fracture in theſe Bones.

The other Bones of the *Neck* are the σπόνδυλοι or *Vertebræ*; but before we come particularly to deſcribe theſe, it will be convenient to premiſe ſomething concerning all the *Vertebræ* of the Spine in general.

Vertebræ *of the whole Spine, their Number, Subſtance, Parts and Holes.*

There are reckoned thirty *Vertebræ* of the Spine in all; *viz.* ſeven of the *Neck*, twelve of the *Thorax*, five of the *Loins*, and ſix of *Os ſacrum.* Each conſiſts of a *Body*, that is convex forwards and ſomewhat hollow behind, but above and below plain: which body is not of a ſolid and hard ſubſtance, but ſomewhat fungous and ſoftiſh. This body has three ſorts of *Proceſſes* growing out of it toward its hinder ſide, two tranſverſe, four oblique, and one poſterior or acute, which are of an harder ſubſtance than it ſelf. There is alſo a large *proper Hole* in its middle, (or rather betwixt it and its Proceſſes) for the deſcent of the Spinal Marrow: and on its upper and under ſides two ſmall lateral *common* ones, that is common to it ſelf and that next it: for one half of theſe holes is excavated out of the lower ſide of the upper *Vertebra*, and the other half out of the upper part of the lower; and they ſerve for the entrance of the Blood-veſſels into the Spine, and for the exit of the Nerves that ſpring out of the ſame.

Connexion.

The *Vertebræ* are joined to one another *behind* by *Ginglymus*, *forwards* by *Harmonia*; on the *outſide* by an hard Membrane, on the *inſide* by a membranous, hard and ſtrong Ligament, reaching from the firſt *Vertebra* of the Neck to the *Os ſacrum.*

Thus far of what is *common* to all the *Vertebræ*: As for what is *proper* to thoſe of each of the four *Diviſions*, that ſhall be ſhewn in their particular Deſcription.

Vertebræ *of the Neck ſeven.*

And firſt for the *Vertebræ* of the *Neck*, which are in number *ſeven.* The *Bodies* of theſe are leſs, but harder than thoſe of the other, which was convenient becauſe they are more moved. They are not of a ſemicircular Shape like the other, but rather four-ſquare as it were. Their tranſverſe Proceſſes have each an hole in them, (which the reſt have not,) through which Veins and Arteries paſs to the Head. Their *poſteriour* Proceſſes or Spines are forked or cleft into two, except in the firſt and laſt *Vertebræ.*

1. Atlas.

The *firſt* or uppermoſt *Vertebra* is called *Atlas*, becauſe the Head ſtands upon it, like the Globe of the World. It hath no Spine behind (onely a little blunt knob) leſt the two ſmall Muſcles of the Head (called *Obliqui inferiores*) ſpringing from the ſecond *Vertebra* and inſerted into this, ſhould be hurt, when the Head is bowed forward. *Spigelius* ſays it has no true *Body*, but rather (inſtead of it) a Tubercle in its foreſide. Both its obliquely aſcending and obliquely deſcending Proceſſes have each a *Sinus* in them: the upper receiving the Tubercles of the *Occiput*, and the lower the aſcending Proceſſes of the ſecond *Vertebra.* Upon theſe the Head is moved forwards and backwards. The ſubſtance of this *Vertebra* is harder, ſolider, but thinner than that of the reſt, becauſe it is the leaſt, and yet its Cavity is biggeſt. Within on the foreſide of its great *Foramen*, it has a ſemicircular *Sinus* lined with a Cartilage, whereinto it receiveth the tooth-like Proceſs of the ſecond *Vertebra.*

2. Dentata. The *ſecond* is called *Vertebra dentata*, becauſe out of its upper ſide, between its two aſcending Proceſſes, there ſprings a round, longiſh and hard Proceſs, in ſhape like a *Tooth*, which being inveſted with a Cartilage is jointed into the foreſaid *Sinus* of the firſt *Vertebra*, upon which as upon an *Axis* the Head with the ſaid firſt *Vertebra* turns round. And when a luxation happens here, the Neck is ſaid to be broken. This tooth-like Proceſs in that part which enters not into the ſaid *Sinus*, is invironed with a Ligament, by which it is knit to the *Occiput*. The hinder Proceſs of this *Vertebra* is cleft into two, as thoſe of the four following are, for the more convenient inſertion of the Muſcles and Ligaments. Its *tranſverſe* Proceſſes are leſs than theirs, and have alſo ſmaller holes.

The other five. The *four* that lie next under this are in all things like it, ſave that their tranſverſe or lateral Proceſſes are larger, and divided into two as well as the hinder. The *ſeventh* is the largeſt of all. It is liker to the *Vertebræ* of the *Thorax* than of the Neck; for neither its tranſverſe nor hinder Proceſſes are cleft like the foregoing, but both are like thoſe of the *Vertebræ* of the *Thorax*, to be deſcribed in the next Chapter.

CHAP.

CHAP. XI.

Of the Vertebræ *of the* Thorax.

IN the next place we come to the Bones of the *Trunk*, which is divided into the *Thorax* and *Abdomen*.

The Bones of the *Thorax* are the *Vertebræ* of the Back, the *Ribs* and *Breaſt-bone*.

Vertebræ *of the Back twelve.*

Firſt, as for the *Vertebræ*, they are *twelve* in number, unto which ſo many Ribs (of a ſide) anſwer; there are ſeldom thirteen of each, but more ſeldom eleven. Their *Spines* or *hinder* Proceſſes are not divided into two as thoſe of the Neck, but are ſolid and ſimple. The *tranſverſe* are ſhort and blunt, and have each a ſhallow *Sinus* for the inarticulation of the Ribs; but are not perforated like thoſe of the Neck. The *oblique* Proceſſes (which are four, two aſcending, and two deſcending) ſerve for the articulation of one *Vertebra* with another. The deſcending are a little hollowed, and receive the (ſomething protuberant) Heads of the aſcending Proceſſes of the next *Vertebra* below them, ſucceſſively. The fore-part of their *Body* next to the cavity of the *Thorax* is round, or convex; and the hinder part lunated, or concave. On each ſide they have a ſmooth *Sinus* for the reception of the heads of the Ribs; for into theſe *Sinus* they are received as well as into thoſe of the tranſverſe Proceſſes. As for their *Holes*, they have one large proper one in their middle, which containeth the Spinal Marrow; and the one half of two *common* leſſer ones, that is, one half on their upper ſide, and another on their lower, as they join to one another, for the egreſs of the Nerves, and ingreſs of the Veins and Arteries, as was ſhewn before in the general deſcription of the *Vertebræ.*

CHAP. XII.

Of the Ribs.

The Ribs. Their Subſtance.

THE *ſecond* ſort of Bones in the *Thorax* are the Ribs, which (as was ſhewn in the former Chapter) are uſually *twelve* in number. Their *Subſtance* is partly bony, partly cartilaginous; the firſt ſerving for firmneſs and ſtrength, the ſecond for articulation, and the eaſier motion of the Breaſt in reſpiration. The bony Subſtance towards the *Vertebræ* of the Back is thick and roundiſh, but towards the *Sternum* flat and thin, and ends in a Cartilage. Within, their bony part is fungous or ſpongie; whence the Ribs being broken are more readily joined together by a *Callus* than moſt other Bones. The Cartilages in bigneſs anſwer the Bigneſs of the Ribs: for the bigger Ribs have the bigger Cartilages; and on the contrary. The Ribs in the upper ſide are blunt or broadiſh, but in the under ſharper. In their lower and inner ſide they have a furrow that runs along them to receive the intercoſtal Veſſels, the Veins, Arteries and Nerves.

The Ribs are of two ſorts, *viz. long* or *ſhort.*

Seven Veræ.

The *long* (otherwiſe called the *true* Ribs) are *ſeven* in number (being the uppermoſt:) Theſe are articulated both with the *Vertebræ* and *Sternum.* Their cartilaginous ends or heads are received into ſhallow *Sinus's* in the Breaſt-bone, and their bony heads being covered with a Cartilage are received into the *Sinus's* in the bodies of the *Vertebræ*; and the ſame heads have each a Tubercle (except the two loweſt) that being alſo lined with a Cartilage, are articulated into the ſhallow *Sinus's* of the tranſverſe Proceſſes. The articulation into the Breaſt-bone, is by *Arthrodia*; but that into the *Vertebræ*, by *Synarthroſis*; for the motion of the Ribs at that end is very obſcure, as being ſtraitly tyed to the *Vertebræ* by Ligaments.

Note, That the Cartilages of theſe true Ribs are uſually obſerved to be harder in Women than in Men; which may ſeem to be for the better ſuſtaining of the weight of their Breaſts that lie upon them.

The *ſhort* (otherwiſe called *Nothæ* or *Spuriæ*, baſtard Ribs) are *five* in number; of which the four uppermoſt having their Cartilages bending upward and cleaving one to another, are joined before to the lower ſide of the Cartilage of the ſeventh true Rib: but the laſt, which is the leaſt, is looſe from the reſt, and grows ſometimes to the Diaphragm, and ſometimes to the *Muſculus rectus* of the *Abdomen*, as alſo ſometimes does the loweſt of the four next above it. Behind they are joined to the *Vertebræ* of the Back, like as the true Ribs were; onely the two loweſt, (and ſometimes the third) are received only into the bodies of the *Vertebræ*, and not into the tranſverſe Proceſſes which here have no *Sinus* for their reception. *Five Nothæ.*

The

Uſe. The *Uſe* of all the Ribs is *firſt*, to keep the Breaſt and the upper part of the *Abdomen* diſtended, that in the former the Heart and Lungs may have free ſpace for their motion; and in the latter, the Stomach and Liver might not be preſt upon by the circumjacent parts. *Secondly*, to preſerve thoſe parts from external injuries, as from bruiſes or the like. And *laſtly*, to ſuſtain the Muſcles that ſerve for reſpiration, and to yield to or obey their motions; for if the Breaſt had been environ'd with one continued Bone, it had not been capable of dilatation in inſpiration, nor of contraction in expiration.

CHAP. XIII.

Of the Breaſt-bone or Sternum.

The Sternum, *its ſubſtance.* THE *Sternum* (which is the laſt bone of the *Thorax*) is ſeated in the middle of the Breaſt before, ſerving as a Breaſt-plate, and having the cartilaginous productions of the true Ribs inarticulated into it. It is of a red fungous *ſubſtance*, and in Children almoſt wholly cartilaginous; only its uppermoſt part is in them ſomewhat more bony than the reſt, perhaps becauſe one end of the *Clavicula* is joynted into it. In Infants it conſiſts of ſeven or eight, but after ſome years they ſo coaleſce one to another, that in the adult it is compounded but of three, and in aged perſons it ſeemeth but one Bone; yet it is diſtinguiſhed by two tranſverſe lines, ſhewing the former diviſion, which are more conſpicuous in the inſide than outſide.

The

It conſiſts of there Bones and a Cartilage.

The *uppermoſt* Bone is thickeſt and broadeſt; it hath in each ſide a longiſh Cavity lined with a Cartilage, to receive the heads of the Clavicles: between theſe in its middle and upper part is a lunated pit called *Jugulum.* It has alſo a ſmall *Sinus* or Dent on the inſide, to give way to the Wind-pipe deſcending. The *ſecond* Bone is neither ſo thick nor ſo broad, yet a good deal longer. It is joined to the former by an intervening Cartilage, and in each ſide has five or ſix *Sinus* for the inarticulation of ſo many of the true Ribs. The *third* is the ſhorteſt of all, yet it is broader than the ſecond, unto the lower end of which it is joined. What true Ribs were not jointed into the middle Bone, are received by this. To its lower end is annexed the Cartilage called *Mucronata* or *Enſiformis*, Sword-like. This Cartilage is triangular, about an inch long, and on the outſide of it there is formed a Cavity in the Breaſt, called *Scrobiculus Cordis* or the Heart-pit; and the gnawing Pains ſometimes felt there, *Cardialgiæ*; though thoſe Pains are not from any primary Affection of the *Heart*, but of the *upper Orifice of the Stomach*, which lies under this Cartilage, and has the name of *Cardia*, from its great conſent with the Heart, (as ſome derive the reaſon of its name.)

CHAP. XIV.

Of the Vertebræ *of the Loins.*

THE Bones belonging to the *Abdomen* (which is the *ſecond* or lower part of the *Trunk*) are theſe; five *Vertebræ* of the Loins, five or ſix of *Os ſacrum*, *Os Coccygis* and *Oſſa innominata.*

The

Vertebræ *of the Loins five.*

The five *Vertebræ* of the Loins are larger than thoſe of the *Thorax*, and the loweſt of them are biggeſt. They are jointed with the laſt *Vertebra* of the Back and the firſt of *Os ſacrum*, and with one another, by an intervening clammy Cartilage, but more looſly than thoſe of the Back, becauſe the Body bends more upon them. Their *Bodies* are larger than thoſe above them; and among themſelves the lower the larger: but they are of a very rare and pumice-like Subſtance. Their middle and lateral *Holes* are like thoſe of the Back, only the larger half of the lateral is excavated out of the lower *Vertebra*, whereas thoſe of the Back are formed equally out of both. As for their *Proceſſes*, their *poſteriour* (or Spines) are *ſhorter* and more blunt, but broader and thicker than thoſe of the *Vertebræ* of the *Thorax*, and turn ſomething upwards; but their *lateral* are *longer*. They alſo differ in their inarticulation one with another; for whereas in thoſe of the *Thorax* the upper *(oblique)* Proceſſes were knobby, and the lower hollow, to receive them; in theſe the contrary is ſeen; for the upper Proceſſes are hollow, and the lower knobby. Onely the laſt or twelfth *Vertebra* of the *Thorax* has both its aſcending and deſcending oblique Proceſſes hollowed, to receive the heads or knobs of the Proceſſes of the laſt but one of the *Thorax*, and of the firſt of the Loins.

CHAP. XV.

Of the Os ſacrum, *and* Os coccygis *or Rump-bone.*

Vertebræ *of* Os ſacrum *five or ſix.*

THE *Os ſacrum* is the broadeſt of all the Bones of the Back, and doth ſuſtain all the other *Vertebræ.* On the inſide it is ſmooth and hollow, on the outſide convex and uneven, being of ſomething a triangular ſhape. In its upper part on each ſide it is knit firmly to the *Oſſa Ilia* by an intervening Cartilage. It conſiſts of five or ſix Bones, plainly diſtinguiſhable in Infants, but more obſcurely in grown perſons. Theſe Bones have the reſemblance of (and are uſually called) *Vertebræ*, for each of them hath a *Body* and *Proceſſes*, and a large *hole* to receive the *Spinalis medulla.* The Bodies of theſe differ from thoſe of the other *Vertebræ* in this reſpect; that whereas in thoſe, the lower part is always bigger, in theſe it is the leſs; by which means the uppermoſt of them is the biggeſt, and the loweſt the leaſt. Their ſmaller holes which ſerve for the ingreſs and egreſs of Veſſels differ alſo from thoſe of the other, in that they are not in their ſides, but before and behind; of which thoſe before are much the larger. As for their *Proceſſes*, the *oblique* can hardly be diſcerned, except in the firſt. The *tranſverſe* are pretty long, but ſo united, that all ſeem but one. The *binder* or ſpines are like thoſe of the Loins, but leſs, and ſtill the lower the leſſer; inſomuch that the loweſt hath no Proceſs, but only a round Protuberance.

Os Coccygis.

To the *Os ſacrum* the *Os Coccygis* or Rump-bone is joined by a Cartilage, ſomewhat looſly, that it may bend a little backwards in Women in travail for the freer paſſage of the *Fœtus*, *&c.* It is compounded of three or four Bones, of which the firſt hath a ſmall hollowneſs which receiveth the laſt *Vertebra* of *Os ſacrum.* The reſt of its Bones grow each leſs than other, ſo that the loweſt ends in a cartilaginous point. It's called *Os Coccygis*, becauſe in ſhape it reſembleth the Cuckow's bill. Its lower end bends inward, to ſtay the ſtreight Gut and the Sphincter-Muſcle, which are tied to it. The Bones of it are ſpongie and ſoft, and have neither Proceſs nor any hollowneſs, for the ſpinal marrow deſcends no further than the bottom of *Os ſacrum.*

CHAP. XVI.

Of the Oſſa innominata.

Oſſa innominata, *their name.*

AT the lower end of the *Abdomen*, by the ſides of the *Os ſacrum*, there ſtand two large bones called by *Galen Oſſa innominata* (nameleſs bones) becauſe they had then no proper name impoſed upon them, that he had met with. But *Spigelius* ſays, that *Homer* had long before called them *ἰσχία*, and that they have been generally by later Anatomiſts known by that name: (though, by his leave, I think that *Iſchium* is more commonly taken onely for one part of theſe bones called *Coxendix.*)

Situation and Connexion.

But be their Name what it will, there is one on each ſide the *Os ſacrum*, to which they are joined (through the intervention of a Cartilage) by a moſt ſtrong Ligament, and together with it frame the *Pelvis*, or that Cavity in which the Womb, Bladder and part of the Inteſtines are contained.

Parts.

In Children each of them plainly appeareth to be framed of *three* Bones (called *Os Ilium*, *Coxendicis*, and *Pubis*) joined by a Cartilage, until the ſeventh year; but in Men of ripe Age theſe three, the Cartilage being dried and hardened into a Bone, ſeem but one entire Bone. However for the more exact Deſcription of its parts, we muſt conſider it as conſiſting of *three*.

1. Os ilium.

The *firſt* is called *Os Ilium*, becauſe under it lieth the ſmall Gut called *Ilium*. This is the uppermoſt and broadeſt; in figure Semicircular; arched without, within hollow. It is joined with the *Os ſacrum* by a common membranous and moſt firm Ligament, with a Cartilage intervening, as aboveſaid.

2. Coxendix.

The *ſecond* is called *Os coxendicis*, (or *Iſchium*) and in Engliſh the Hip-bone: though ſometimes both theſe laſt names are taken in a larger ſignification, and include all the three. This Bone is the lower and outer part of the *Os innominatum*, and has a large Cavity in it (called *Acetabulum coxendicis*) which receives the round head of the Thigh-bone, by the articulation called *Enarthroſis*. The brims of this Cavity are tipt as it were with a Cartilage, called its *Supercilium*. Beſides this it has another *Sinus* in its hinder and inner ſide, in which the Muſcle of the Thigh called *Obturator internus* windes about that part of this Bone (as a Rope in a Pulley) according to *Spigelius.* Its lower End has a large *Appendix* which we reſt or bear upon when we ſit.

3. Os pubis. The *third* Bone is called *Os Pubis*, and *Pectinis*, or the Share-bone. This is the lower and inner or fore part of the nameleſs Bone, and eaven before is joined to its fellow by a Cartilage, which is much thicker, but looſer and ſofter in Women than in Men; for in the former one Bone does uſually recede a little from the other in Travail, to give way to the *Fœtus.* It has a very large *Foramen* between the *Sinus* of the *Coxendix*, and that part whereby it is joined to its fellow, making room for two Muſcles of the Thigh. And above this *Foramen* is a *Sinus*, by which the crural Veins and Arteries paſs to the Thighs.

The Pelvis. *Note*, That the *Pelvis* that is compoſed by theſe three Bones and the *Os ſacrum*, is bigger in a Woman than in a Man, to make the larger room for the *Fœtus.*

CHAP. XVII.

Of the Scapula *or Shoulder-blade.*

HAving done with the Bones of the *Head* and *Trunk*, there remain to be deſcribed the Bones of the *Limbs*, which are the *Arms* and *Legs.* The Bones of the Arms are either *above* the joint of the Shoulder, or *under.*

The Bones of the Limbs.

The Scapula. *Above* the joint lieth the *Shoulder-blade*, in Greek called ὠμοπλάτη, in Latin, *Scapula.* Some reckon this to the *Thorax* becauſe of its ſituation, as lying upon its upper and back part: but ſeeing its principal uſe ſeems to be for the ſuſtaining and motion of the Arm, we have conſider'd it as a part thereof. Its *Subſtance* is for the greateſt part thin, but hard and ſolid. Its outſide is a little arched, and its inſide hollow. It is ſomewhat of a triangular *Figure*, and joined to ſundry parts by means of the Muſcles; which ſort of union we called above, *Syſſarcoſis*. Thus it is joined to the Bone of the *Occiput* by the cucullar Muſcles, or the firſt pair of the *Scapula*; to the *Vertebræ* of the Neck by the ſame pair, as alſo by the ſecond and fourth pairs, *&c.*

Its Subſtance, Figure and Connexion.

Proceſſes.

It has three *Proceſſes*: of which *one* is extended along its middle, and is called its Spine; and that end of it that by a ſhallow *Sinus* receives the *Clavicula*, *Acromium*, its point or tip: *Another* is lower and leſs than this, and acute, ſomething like a Crow's Bill, whence it has the name of *Coracoides*; by others it is called *Ancyroides*, Anchor-like: The *laſt* is the ſhorteſt, called *Cervix* its Neck. In the end of this is a *Sinus* that in its upper part is acute, but in its lower round: this Cavity being but ſhallow of it ſelf has its brims tipt with a Cartilage, which makes it the deeper, into which the head of the Shoulder-bone is received. This articulation is ſtrengthened by very ſtrong Ligaments and Tendons, and is partly hindred from Luxation by the top of the ſecond Proceſs.

Uſe.

The Shoulder-blade hath a three-fold *Uſe*. Firſt, it receiveth the *Os humeri* in the *ſinus* of its *Cervix*, by the articulation called *Arthrodia*; as it does the *Clavicula* in the *ſinus* of its *Acromium* by *Synarthroſis*. Secondly, ſundry Muſcles ſpring from the Shoulder-blade, which ſerve for the motion of the *Os humeri*. Thirdly, it defendeth the Back ſo far as it reacheth, from external injuries, like a Shield.

CHAP. XVIII.

Of the Os humeri *or Shoulder-bone.*

THE Bones of the Arm *under* the joint of the Shoulder are the *Shoulder-bone*, the *Cubit-bones*, and the *Bones of the Hand.*

Os humeri. The *Shoulder-bone* is but one in each Arm, reaching from the Shoulder to the Elbow. In figure it is round, only a little flattiſh behind towards the Elbow; of a hard and ſolid ſubſtance. It is hollow all along like a Pipe, wherein a marrowy ſubſtance is contained.

Its upper end. Its *upper* end, that is jointed to the *Scapula*, has a great and round Head, cover'd with a Cartilage, which is received into the Cavity of the *Scapula* by that kind of articulation which is called *Arthrodia.* On the hinder ſide of this Head there ſtand two rough and uneven Prominences, (which *Spigelius* reckons for another Head) into which the Ligaments are inſerted. And betwixt theſe two Prominences there is a round and long chink through which the nervous Head of the *Muſculus biceps* doth paſs.

The lower. Its *lower* end is articulated with two Bones, *viz.* the *Ulna* and *Radius*, by *Ginglymus*, for it both receives them and is received by them, having three Proceſſes and two *Sinus* betwixt them; ſo that this end reſembles a Pulley, whence it is called *Trochlea.* The *Ulna* is jointed with its inmoſt Proceſs, and the *Radius* with the outmoſt. On its inſide, beſides the three foregoing, it has a large Proceſs or Tubercle from whence thoſe Muſcles ariſe that lie on the inſide of the Cubit;

and another leſs on its outſide, from which thoſe Muſcles ſpring that lie on the outſide. On the hinder ſide of the *Trochlea* there is one deep large Cavity, and on the foreſide two ſmall ones, into which the Bones of the Cubit hit, when they are moved backward or forward, and are ſtopped from being carried further. About the middle of this Bone in the inſide, there is an hole through which Veſſels paſs to the marrowy ſubſtance for its nouriſhment.

CHAP. XIX.

Of the Bones of the Cubit.

Two Bones of the Cubit, viz.

THE Bones of the *Cubit* are *two*; to wit, the *Ulna* and *Radius*. Their ſubſtance is firm and ſolid, all but their Appendages. They are near of the ſame length (but the *Ulna* is the longer of the two) and both are hollow within, containing a marrowy ſubſtance. They are in ſome places rough in their ſuperficies, by reaſon of their lines that are appointed for the Riſe or Inſertion of the Muſcles.

The *Ulna* (otherwiſe called *Os Cubiti*, and *Cubitus*) is larger in its upper end that joints with the *Os humeri*, and grows ſmaller and ſmaller towards the Hand, ending in a round Tubercle or ſmall Head, with a round *Sinus* in it, (on whoſe hinder ſide there grows a ſmall ſharp Proceſs, from its ſhape call'd *Styloides*) receiving one of the Bones of the *Carpus*, to which it is knit by Ligaments, (a Cartilage intervening.) Its upper end is articulated with the *Os humeri* by *Gingly-* 1. Ulna.

mus, to which end it has two Proceſſes, one before and another behind. That before, is received into one of the fore *Sinus* of the *Os humeri* (mentioned in the former Chapter) in bending the Elbow-joint: and the hinder upon ſtretching out the Arm enters into the hinder Cavity of the ſame Bone behind the *Trochlea*, (by which the Cubit is ſtayed from further extenſion than to a ſtreight poſture) and is called *Ancon* or *Olecranum*. And at the ſame end it has alſo two *Sinus*, the one of which is lateral and external, receiving the Head of the *Radius*; and the other (which is betwixt its two Proceſſes) one of the Proceſſes of the *Os humeri*, which moves in it as a Rope in a Pulley. As it receives the *Radius* in its upper end, ſo is it received by it in its lower: but in the midſt it bends or recedes a little from it, yet is knit to it by a long Ligament.

2. Radius. The *ſecond* Bone is called *Radius*, and lies on the outſide of the Cubit. Its upper end is ſlenderer, having a round Head, one ſide of which is received by the *Ulna*; but its tip has a round ſhallow Cavity in it, which receives the outer Proceſs of the *Os humeri*, by *Diarthroſis*. Its lower end is thicker and broader, and by a little *Sinus* in its ſide receives the *Ulna*: and at its extremity it has two other ſmall *Sinus*, for the reception of the little Bones of the Wriſt.

CHAP.

CHAP. XX.

Of the Bones of the Hand.

Four ſorts of Bones of the Hand.

THE *Hand* is divided into three parts: the Wriſt, called *Carpus*; the diſtance between the Wriſt and Fingers, called *Metacarpus*; and the *Fingers* themſelves.

1. *Eight of the* Carpus.

The Bones of the *Wriſt* are *eight* in number, placed in two ranks or orders. The *upper* rank hath four Bones, of which three are ſo joined together that they ſeem but one; (theſe are articulated to the *Ulna* and *Radius* by *Arthrodia*:) but the fourth being the leaſt of all, is placed a little out of its rank on the outſide of the third. The *inferiour* hath alſo four Bones; they are joined to one another by *Harmonia*, but to the Bones of the *Metacarpus* by *Synarthroſis*, having ſome motion though but obſcure. They are firmly knit to one another by both a membranous and cartilaginous Ligament; and beſides, by another called *Annular*, which compaſſing the Wriſt, comprehendeth both them and the Tendons of the Muſcles which paſs to the Fingers.

2. *Four of the* Metacarpus.

The *Metacarpus* hath four Bones, they are round, and of a ſolid ſubſtance, but hollow within like a Pipe, being full of Marrow. They are bigger than thoſe of the Fingers: that which anſwereth to or ſuſtaineth the Fore-finger is thickeſt and longeſt, and the reſt grow each ſhorter and ſlenderer than the foregoing. Between each two a diſtance is left for the *Muſculi interoſſei* of the Fingers. Both in their upper and lower end they have an *Appendix*; that at the upper end hath a

Cavity which receiveth the Bones of the *Carpus*; but that at the lower, a round long head, covered with a Cartilage, which is received by the *Sinus* of the firſt Bone of the Fingers, to which the Bones of the *Metacarpus* are tied by a tranſverſe Ligament, that lies in the Palm of the Hand.

3. *Fifteen of the Fingers.*

The *Fingers* (taking in the Thumb) have fifteen Bones, each three. The firſt are largeſt, the ſecond leſs, and the third the leaſt. On the outſide they are round, but on the inſide plain and a little hollow, that they may lay the firmer hold upon things. Each has an *Appendix* (called by ſome a *Proceſs*) at each end. The *upper Appendices* are round, and thoſe of the firſt Bones have one round *Sinus* in them whereby they receive the round head of the Bones of the *Metacarpus*: but the upper *Appendices* of the ſecond and third Bones have each two *Sinus*, parted by a ſmall Protuberance. The lower *Appendices* have each two heads divided by a *Sinus*, which are received by the double *Sinus* of the upper *Appendices* of thoſe Bones that join to them: except onely the laſt or third Bone, which is received by none, but is fenced by a Nail. The ſecond Bone is joined to the firſt, and the third to the ſecond by *Ginglymus*, and by them the Fingers are onely ſtretched out and contracted. For as for their motion ſideways, that depends only upon the articulation of the firſt Bones with the Bones of the *Metacarpus*, which is done by *Enarthroſis*, or at leaſt by *Arthrodia*. The jointings of the Thumb anſwer to theſe of the Fingers, ſaving that its *upper Appendix* is not joined to any Bone of the *Metacarpus* (with which it has no communication) but immediately to the Wriſt; and its *lower* has but one head, whence the ſecond Bone has but one *Sinus* in its upper Appendix to receive it.

4. Oſſa ſeſamoidea. Beſides theſe Bones there are in the in-ſide of the Hand, at the joynts of the Fingers, ſome ſmall bones called from their figure and bigneſs *ſeſamoidea*, like the Grains of *Seſama*, (a ſort of Indian Corn ſo called by *Pliny.*) They reſemble in figure the Knee-pan, and ſeem to ſerve for the ſame uſe; for in ſtrong Extenſions of the Fingers they ſtrengthen the Tendons of the Muſcles upon which they are placed, and hinder the luxation of the Joynt. Authors differ very much as to their number, becauſe being ſo ſmall they are ſeldom all found; but moſt agree upon the number of 12 to each Hand, placing them thus. At the joynting of the ſecond bone of the Thumb with the firſt there are two. The ſecond and third joynt of the fore-Finger have each one; but its firſt joynt, as alſo the firſt of the other three have each two. In Children they are of a cartilaginous ſubſtance, but grow bony by degrees, (being inveſted with a Cartilage) yet not ſolid but fungous or porous.

CHAP. XXI.

Of the Thigh-bone, and Patella.

THE *Leg* (in a large ſenſe) is divided into three parts, the *Thigh*, the *Shank* (or Leg ſtrictly ſo called) and *Foot.*

The *Thigh* hath but one Bone: but of all others it is the longeſt and thickeſt. *Before*, it is Os femoris.

round: but *behind*, ſomething depreſſed, and hollow. In the *upper* part it has a round head; the ſlender part under this is called its Neck, and is pretty long and oblique. The Neck is an *Apophyſis* or Proceſs to the Bone it ſelf, and the round Head an *Epiphyſis* or Appendix to the Neck. This Head is received by the large Cavity or *Acetabulum* of the *Coxendix*, and is detained therein by two ſtrong Ligaments; one that encompaſſes the brims of the *Acetabulum*, and another that ſprings out of its bottom, and is inſerted into the tip of this round Head or *Appendix*. At the lower end of the Neck, there ſpring two Prominences from the Bone; which, becauſe the Muſcles called *Rotatores* are faſtened to them, are called *Trochanteres*. The hinder and lower is the leſſer *Trochanter*; and the lateral or uppermoſt, the bigger. The *lower* end of the Thigh-bone growing thicker by degrees hath two pretty large Heads, leaving a Cavity in the middle that receiveth the *Apophyſis* of the *Tibia*, (which is tied therein by a Ligament, as the upper head of this bone is into the *Acetabulum* of the *Coxendix*:) And again theſe are received by the Cavities of the *Tibia*, by a looſe *Ginglymus*, both the Heads and Cavities being lined with Cartilages. The forepart of this Articulation is called the *Knee*, the hindermoſt the Ham.

Patella. Upon the Knee appeareth a Bone, not joyned with any other Bone, called the *Pan*, or *Patella*: it is roundiſh, about two inches broad, plain without, but convex within, and covered with a Cartilage. It is ſet before the Thigh-bone and the *Tibia*, to ſtrengthen the Articulation; for otherwiſe the Thigh-bone would be in danger to ſlip out forward in going down a Hill, or the like.

Its ſubſtance in Infants new born is ſoft and cartilaginous, and remains ſo for many Months; but in proceſs of time it becomes bony. It is full of little holes, as all thoſe bones are which paſs from Cartilages into Bones. It is involved by the thick Tendons of the ſecond, third, and fourth Muſcles that extend the *Tibia*, (and are implanted into its fore knob) whereby it is fixed in its place.

Behind there are two *Oſſa ſeſamoidea*, which adhere to the two beginnings of the *Gaſtrocnemius externus*, (or firſt Muſcle which extends the Foot) to ſtrengthen them.

CHAP. XXII.

Of the Bones of the Leg.

The bones of the Leg two.

THE *Shank* (or *Leg* ſtrictly ſo called) is compoſed of two Bones. The greater is called κνήμη *Tibia*, the leſſer περόνη *Fibula*. Theſe are ſlightly articulated into one another near each end; but in their middle they recede one from the other, yet ſo as they are tied together by a ſtrong membranous Ligament that comes between them.

1. Tibia.

The *Tibia* (commonly called *Focile majus*) is partly three-ſquare, by its ſharp edge before making what we call the Shin. It has an appendix at each end. That above is bigger, and in its upper part hath one Proceſs, which is received by the *Sinus* of the Thigh-bone; and two longiſh Cavities for the receiving of the two Prominences or Heads of the Thigh-bone, (ſo that the

Articulation is by *Ginglymus*) as was ſaid in the foregoing Chapter. About the brims of theſe *Sinus* there is joined by Ligaments a moveable Cartilage, ſoft, ſlippery, and bedewed with an unctuous humour, from its ſhape called *Cartilago lunata*, the Moon-like Cartilage. It has alſo a little Head behind (below the foreſaid *Appendix*) which enters into the *Sinus* of the upper *Appendix* of the *Fibula*. Its lower *Appendix* is leſs than the upper, jetting out with a notable Proceſs toward the inſide of the Foot, making the *Malleolus internus* or inner Ankle. It has two Cavities; one leſs in its ſide, by which it receives the *Fibula*; another greater and lower, divided as it were into two by a ſmall Protuberance in the middle, and lined with a Cartilage, receiving the convex head of the *Talus* that lies under it; as the ſaid Protuberance is received by the ſhallow *Sinus* in the convex head of the *Talus*: the one being articulated into the other by *Ginglymus*, ſo that the Foot is moved upwards and downwards (or bended and extended) upon this joint.

2. Fibula. The leſſer and outer Bone of the Leg is called *Fibula* (or *Focile minus*;) it is as long as the former, but much ſlenderer. This has alſo an *Appendix* at each end: the upper of which reaches not ſo high as the Knee, nor is it jointed to the Thigh-bone; but in its inner ſide has a ſhallow Cavity which receives the little hinder (or lateral) Head of the *Tibia*, that is ſeated under its upper *Appendix* which is jointed with the Thigh-bone. The lower *Appendix* of the *Fibula* is received by the *Sinus* of the *Tibia*, and extending its Proceſs to the ſide of the *Talus*, makes therewith the *Malleolus externus* or outer Ankle, which is lower than the inner.

CHAP.

CHAP. XXIII.

Of the Bones of the Tarſus.

OF the *Foot* (as of the Hand) there are three parts, *Tarſus*, *Metatarſus*, and the Toes.

The *Tarſus* is the diſtance between the lower end of the two Focils, and the beginning of the five long Bones which ſuſtain and are articulated with the Toes. Some call it the *Inſtep*, but we have in the former Book (of *the Muſcles*) named it the *Wriſt*, ſuppoſing that by the Inſtep the *Metatarſus* is rather underſtood.

It hath *ſeven* Bones much differing from one another in bigneſs and ſhape. *The* Tarſus *hath ſeven Bones.*

1. Talus.

The *firſt* is called *Talus* or *Aſtragalus* (in Engliſh the Ankle or Huckle-bone.) This is of a various figure: *Above*, it has ſomething a convex head with a ſhallow *Sinus* in it, articulating with the *Tibia*, as is deſcribed in the foregoing Chapter. By the Proceſs of the *Tibia* that makes the inner Ankle it is hedged in as it were on the inſide, as it is by that of the *Fibula* on the outer. *Before*, it has a long neck, on which grows a round head that enters into the *Sinus* of *Os naviculare*; upon which jointing the Foot is moved ſideways. Its *hinder* ſide is rough, and in its upper part has a tranſverſe *Sinus* for the receipt of the Ligament of the *Tibia*, and in its lower a little deſcending *Sinus*, by which the Tendons of the Muſcles of the Foot paſs. *Below*, it has a *Sinus* behind and a Protuberance before, by which it is articulated with the Heel-bone by *Ginglymus*. Betwixt the *Sinus* and Protuberance there is a long and pretty deep Cavity, and over againſt it another ſuch in the Heel-bone. In theſe is contained a mucous ſubſtance which moiſtens the cartilaginous Ligaments that joyn the *Talus* to the Heel-bone, keeping them from drying by continued motion.

2. Os calcis. The *ſecond* Bone of the *Tarſus* is called *Os Calcis* or *Calcaneus*, the Heel-bone, and is the biggeſt of the ſeven. It lies under the *Talus*, with which in its *upper* ſide it is articulated in the manner juſt now deſcribed. *Behind*, it receiveth the great Tendon called *Nervus Hectoreus*, (or the great Cord) compoſed of the Tendons of the three Muſcles that extend the Foot. Its *fore* end is received by the *Os cubiforme*. On its *inſide* it has a large *Sinus*, by which the Tendons and larger Veſſels deſcend to the under-ſide of the Foot; and on its *out-ſide* it is uneven with ſeveral knobs, for the firmer connexion of the Ligaments and Tendons.

3. Os naviculare. The *third* is called *Os naviculare* or *Cymbiforme*, from its figure. *Behind*, it receiveth the *Talus* in a large *Sinus*; but *before*, it is convex, with three flattiſh ſmooth heads that are admitted into the very ſhallow *Sinus* of the three *Oſſa cuneiformia* to be deſcribed preſently.

The remaining *four* are leſs than the three already deſcribed, and ſtand all in one rank; the firſt of them articulates with the Heel-bone, the other three with the *Os naviculare*. There is no Cartilage betwixt them, but they are knit one to another on the out-ſide by a cartilaginous Ligament; and are cover'd both in their hinder and fore-part with a ſmooth Cartilage where they are joynted with other bones.

4. Os cubiforme. The firſt is called *Cubiforme* or Die-like, having ſix ſides. This is big-

ger than the other three that follow; and is ſeated on the out-ſide of the Foot. In its *foreſide* it is joyned to the fourth and fifth bone of the *Metatarſus*; in the *hinder* with the Heel-bone; and in the *in-ſide*, to the third bone of the *Cuneiformia:* but its other three ſides, *viz.* the *outer*, *upper*, and *lower* are joyned to none.

5. *Three* Cuneiformia.

The three enſuing are called *Cuneiformia*, or wedge-like Bones; for above they are thick, and below thinner, ſo that being joyned, they all of them repreſent a Vault, being convex on the upper-ſide, but on the under hollow; in which hollowneſs the Tendons and Muſcles are lodged, ſo that one does not preſs upon and bruiſe them in going. The firſt of theſe Bones is the greateſt, ſeated in the in-ſide of the Foot; the ſecond is the leaſt, placed in the middle; the third is in the mean between both in bigneſs, and ſtands next to the *Cubiforme*. Theſe three, *behind*, are joyned to the *Os naviculare*, and *before* to the three firſt Bones of the *Metatarſus*.

CHAP. XXIV.

Of the reſt of the Bones of the Foot.

The bones of the Inſtep five.

THE *Metatarſus*, or Inſtep, hath *five* Bones; for one is appointed for the ſuſtaining of the great Toe, as well as others for each of the reſt: though in the Hand it is not ſo, where the Thumb has no bone in the *Metacarpus* anſwering to it.

Their ſubſtance is very hard and ſolid, but they are hollow within like ſo many Pipes, and are longer than the bones of the back of the

Hand. That which ſtayeth (or is articulated with) the great Toe is thickeſt, but the longeſt is that which ſtayeth the next Toe: the other three grow each ſhorter than other, but are almoſt of an equal thickneſs. Their lower ends being round are inſerted into the *Sinus* of the firſt joynts of the Toes: but the upper in their own ſhallow *Sinus* receive the Bones of the *Tarſus.*

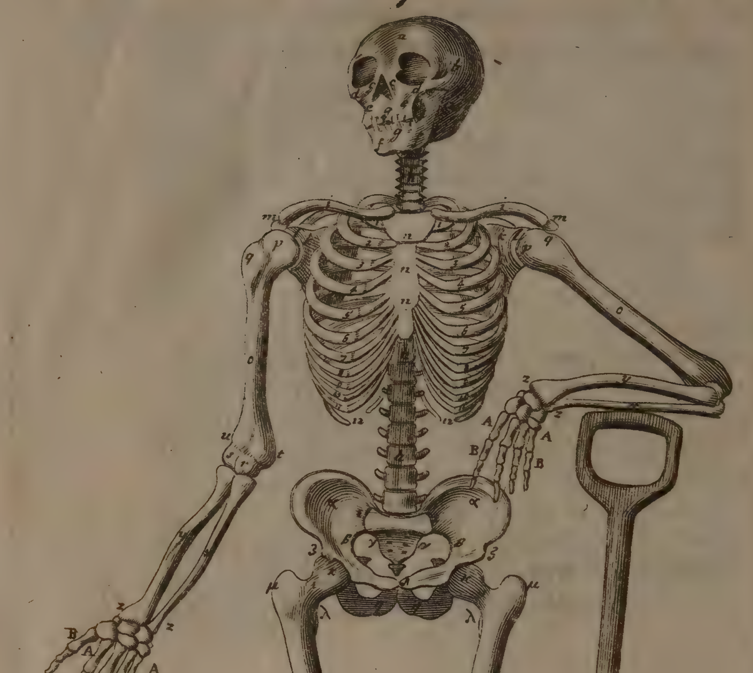
Of the Toes fourteen.

The Bones of the *Toes* are in number *fourteen*; for the great Toe hath only two, but the reſt three. Theſe bones are ſolid without, and hollow within like thoſe of the Inſtep. Their articulation is altogether like that of the Fingers, ſo that we ſhall not need here to deſcribe it over again.

Each Foot has twelve *Oſſa ſeſamoidea*, as well as the Hands; which agreeing both in ſhape and ſituation with one another, the Reader may be ſatisfied concerning theſe of the Feet in the deſcription of thoſe of the Hand in Chap. 20.

Tab. XVIII.

p. 619. Tab: XVIII.



Tab. XVIII.

Repreſenteth the *Skeleton* of an adult Body on its fore-ſide.

a *The* Os frontis.
b *The* Os temporis.
cc *The two bones of the Noſe.*
dd *The* Oſſa jugalia.
ee *The bones of the upper Jaw.*
ff *The lower Jaw.*
gg *The Teeth in both Jaws.*
hhhh *The* Vertebræ *of the Neck,* Thorax, *Loins and* Os ſacrum.
ii *The* Claviculæ.
kk *The* Scapulæ.
ll *Their firſt Proceſs which articulates with the* Os Humeri.
mm *Their ſecond called* Acromium.
nnn *The Bones of the* Sternum.
oo *The* Os Humeri.
pp *Its upper and inner head that articulates with the* Scapula.
qq *Its upper and outer head which ſerves for the implantation of Ligaments.*
r *The inner head of its lower* Appendix *which receives the* Ulna.
s *The outer head of the ſame* Appendix *which receives the* Radius.
t u *The two Tubercles of the* Os Humeri: t *the internal,* u *the external.*
x *The* Ulna.
y *The* Radius.
zz *The eight Bones of the* Carpus.
AA *The four Bones of the* Metacarpus.

BB *The four Fingers and Thumb, each of which conſiſts of three Bones.*

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. *The twelve Ribs.*

αα *The* Os Ilium.

ββ *The* Coxendix.

γγ *The* Os ſacrum.

δ *The* Os pubis.

εε *The connexion of the* Os Ilium *and* Coxendix *with the* Sacrum.

ζζ ηη *The Tubercles of the* Coxendix : ζζ *The inner,* ηη *the outer.*

θθ *The Thigh-bones.*

ιι *The neck of the Thigh-bone.*

κκ *The upper head of the Thigh-bone that is received into the* Acetabulum *of the* Coxendix.

λλ μμ *The two Trochanters :* λλ *the inner,* μμ *the outer.*

νν *The two lower heads of the Thigh-bone.*

ξξ *The* Patella.

οο *The* Tibia.

ππ *The* Fibula.

ρρ *The* Talus.

σσ Os Naviculare.

ττ *The other Bones of the* Tarſus.

υυ *The five Bones of the* Metatarſus.

φφ *The fourteen Bones of the Toes.*

AN
APPENDIX
TO THE
SIXTH BOOK:
Deſcribing the
CARTILAGES, LIGAMENTS and NAILS.

CHAP. I.

Of a Cartilage.

As an *Appendix* to the Doctrine of *Bones*, we will add a word or two of the *Cartilages* and *Ligaments* of the Body: becauſe the former come neareſt to the nature of Bones; and the latter, as they tye ſeveral other parts one to another, ſo eſpecially the Bones: and laſtly, of the *Nails*, which from their ſimilitude of ſubſtance are alſo conveniently ſubjoyned to the Bones.

A Cartilage, what.

A Cartilage (or Griſtle) *is a ſimilar part, cold, dry, and void of ſenſe, flexible, and not ſo hard as a Bone.* But when by age its glutinous particles are dried up, it many times degenerates into a Bone.

Why moiſt, and inſenſible.

Note, That though a Cartilage be of it ſelf of a dry ſubſtance, yet it is always kept moiſt on its

Superficies by a mucous or ſlimy humour that bedews it, whereby it is made ſlippery and fit for motion. *Note* alſo, that it is an inſenſible part, becauſe it neither admits of Nerves nor Membranes, by which alone parts become ſenſible. Which was ſo ordered by Nature, becauſe otherwiſe, ſeeing they are principally ſeated about the Joynts, all motion would have become painful. This has been the common opinion: But Dr. *Havers* ſays, that the Cartilages are covered with a Membrane (as the Bones are) which he names *Perichondrium*, (though it be only a continuation of the *Perioſteum*) and that from it Fibres paſs into the Cartilages themſelves, whereby they are made (partly) ſenſible. Though he thinks the principal uſe of this Membrane, eſpecially in ſuch Cartilages as are joyned to any of the Bones, is to ſtrengthen their conjunction.

As for the Cartilages of the Eye-brows, Ears, Noſe, *Larynx*, &c. we ſhall not need here particularly to deſcribe them, having done it where we treated of the reſpective parts; only we will obſerve in general, that all the Bones in their articulations one with another, (*viz.* ſuch as admit of manifeſt motion) are covered or lined with Cartilages, for their eaſier and glibber motion; and ſometimes themſelves are the *medium* by which Bones are joyned, which articulation is called *Synchondroſis*, ſuch as that of the *Oſſa pubis*; others by tipping as it were the brims of the Cavities of the greater Joynts, make the *Sinus* deeper; and others laſtly conſtitute parts themſelves, as thoſe of the Ears, *Larynx*, &c.

CHAP.

CHAP. II.

Of a Ligament.

A Ligament what. A Ligament *is a ſimilar part, cold and dry, of a middle Subſtance betwixt a Cartilage and a Membrane, appointed for the tying of ſundry parts together.*

Their differences. *Note*, That as it is either harder or ſofter than is ſuitable to its proper nature, it acquires the Epithets of *cartilaginous* or *membranous* reſpectively: ſo, that which proceeds out of the top of the Thigh-bone and is inſerted into the Cavity of the *Coxendix*, is called a cartilaginous Ligament, for its hardneſs; and that which environeth the joint of the Shoulder, is called membranous, from its ſoftneſs.

Why ſome are inſenſible. Thoſe which tye Bones together are without ſenſe, (for otherwiſe upon every Motion we ſhould have been in pain:) but thoſe that knit other parts together, (as thoſe that tye the Liver, Womb, *&c.* to the neighbouring parts) are ſenſible.

An Enumeration of the principal Ligaments of the Body. Ligaments are found in ſeveral parts of the Body. As *firſt*, the Head being moved upon the firſt and ſecond *Vertebræ* of the Neck, there are four Ligaments to ſtrengthen thoſe Articulations. *Secondly*, a common membranous Ligament begirts the whole articulation of the lower Jaw with the Temple-bone. *Thirdly*, the Bone at the root of the Tongue has four, by which it is tyed to the neighbouring parts; and the Tongue it ſelf has one ſtrong one on its under ſide, (otherwiſe called its *Frænum*) which being too ſhort, or running too near its tip, hindreth its motion. Children being ſo troubled, are ſaid to be Tongue-tyed, and muſt have it cut. *Fourthly*, both the Bodies and Proceſſes of all the *Vertebræ* of the Back are knit together by Ligaments, as alſo are the Ribs with the *Vertebræ* behind, and with the Breaſt-bone before. *Fifthly*, ſundry are to be ſeen in the *Abdomen.* The firſt tyeth the *Os ilium* to *Os ſacrum.* The ſecond knitteth the *Os ſacrum* to the *Coxendix.* The third and fourth knit the Share-bones together, one of them compaſſing them circularly, and the other, which is membranous, poſſeſſing their very *Foramen*, and ſuſtaining the Muſcles in that place. As for the Ligaments of the Liver, Bladder, *&c.* thoſe were diſcourſed of when we deſcribed thoſe parts in *B.* I. *Sixthly*, in the Arm theſe appear. 1. Five tye the *Os Humeri* to the Shoulder-blade. 2. The Bones of the Cubit, *Ulna* and *Radius*, are tyed firſt one to another; ſecondly, to the Shoulder-bone; and thirdly, to the Wriſt by (moſtly) membranous Ligaments. 3. There are two ſorts of Ligaments at the Wriſt; firſt an annular one, which going quite round the Wriſt ſerves to confirm and make ſteady the Tendons of the Muſcles which paſs under it to the Fingers. Some make two of it; and then that on the outſide is for the Tendons of the extending Muſcles; and the other in the inner ſide, for the Tendons of the contracting Muſcles. The other Ligament of the Wriſt ariſing from the lower Proceſſes of the *Ulna* and *Radius*, embraces and ſtraitly ties together the Bones of the Wriſt, and ends in the upper *Appendices* of the Bones of the *Metacarpus.* 4. The Bones of the *Metacarpus* are tyed one to another and to the Bones of the *Carpus* by common

Ligaments. 5. The joints of the Fingers are alſo bound by common Ligaments: and in the Palm of the hand there lies a tranſverſe Ligament that ties the firſt Bone of the Fingers to the Bones of the *Metacarpus*. *Seventhly*, In the Leg are theſe. 1. The Thigh-bone is tied to the *Coxendix* by two Ligaments. 2. The lower end of it is tied to the *Tibia* and *Fibula* by ſix Ligaments. 3. The *Tibia* is joined to the *Fibula* by three membranous Ligaments, *viz.* two common and one proper. 4. The *Tibia* and *Fibula* are joined to the *Talus* by three Ligaments; and there are three other for the ſtrengthening of the Tendons, that paſs under them, and confirming them in their places. 5. The *Talus* is tied with the other Bones of the *Tarſus* by five Ligaments. 6. The Bones of the Inſtep and Toes are tied with ſuch Ligaments as thoſe of the Hand are.

CHAP. III.

Of the Nails.

The Nails.

IN the laſt place we will ſay ſomething of the *Nails*, which though they are not *truly* parts of the Body, yet for their uſefulneſs ought not to be omitted.

Their Subſtance, Colour, &c.

They are of an horny tranſparent *Subſtance*, coming neareſt to that of Bones, faſten'd upon the ends of the Fingers and Toes for their defence. They are endued with no ſenſe, nor is that *colour* which they appear to be of upon the Fingers, owing to their proper ſubſtance, but to the colour of the parts that lie under them;

whence they ſometimes look ruddy, ſometimes pale, blue or yellow, and thereby give ſome intimation of the ſtate of the Body. For thus in a ſwoon they look pale, becauſe little Blood is then driven into the fleſh that lies under them: in a Jaundiſe they look yellow from the Bile that is mixed with the Blood, *&c.* They grow very firmly to the ſubjacent Fleſh; and to faſten them the better, they are tied about their root with a Ligament, and on their ſides the Skin cloſes them in. The parts that lie under them are very ſenſible, for there are ſeveral twigs of Nerves and Tendons of Muſcles that run to the very Fingers ends; ſo that upon handling any hard or rugged thing we ſhould have been continually in pain, if theſe ſo ſenſible parts had not been thus defended by the Nails. Which Defence ſeems to be their principal Uſe; for their Uſe to ſcratch withall is but ſecondary and leſs conſiderable.

In what reſpect they are Parts of the Body. They may in ſome ſenſe be reputed *Parts* of the Body, ſo as that it would not be perfect and intire without them: but that is but an *improper* Notion of a part. For if they were *properly* parts, they ſhould live by the common Life of the Body; but that they do not, ſeeing *they* as well as the *Hair* continue to grow after a Man is dead.

FINIS.